

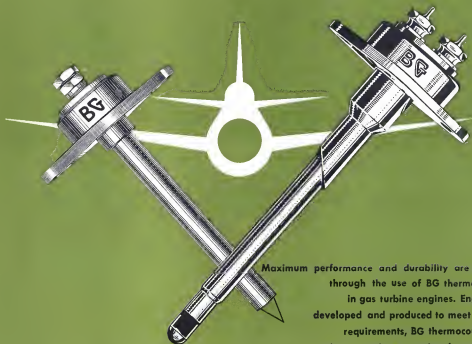
AVIATION WEEK

A MCGRAW-HILL PUBLICATION

SEPT. 28, 1953

50 CENTS

Performance by **BG**



For information on these and other BG products write to

THE

BG

CORPORATION

136 West 52nd Street
New York 19, N. Y.

Maximum performance and durability are assured through the use of BG thermocouples in gas turbine engines. Engineered, developed and produced to meet exacting requirements, BG thermocouples are demonstrating exceptional performance in military aircraft — further evidence that in aviation products there is no substitute for BG quality.

HERE'S A **TOUGH** NEW GRUMMAN



WITH A **WARM** HEART!

U.S. Navy—S-2F anti-submarine aircraft

Packed with the latest submarine detection and destruction devices, this tough new Grumman S-2F will replace the "Guardian," battle-lader teams formerly attached with the Navy. And in the nose is a Janitrol S-50 combustion heater providing heat for cockpit, cabin, electronic and torpedo compartments. Space and weight are always at a premium in modern aircraft, and Janitrol engineers—in at the design stage—can help save both of these important factors on most aircraft heating installations.



This is the non-mounted Janitrol S-50 combustion heater, at 20 000 Btu/hr capacity, used in the Grumman S-2F.



Janitrol



AIRCRAFT-AUTOMOTIVE DIVISION, SURFACE COMBUSTION CORPORATION, TOLEDO 1, OHIO

Regional Sales: Engineering Dept. for the Automobiles, 400 E. Main Ave., Columbus 15, Ohio; Aircraft Engineering Office: New York 35, Broadway, Washington, D. C., 1400 East 10th Highway, Kansas City 30; Inland Area: P. Box 101, 201 East 10th St., Indianapolis 425; The Midwest Div.: Chicago 100, 400 E. Main Ave.; Southern Office: 200 West 11, Mobile 1, Ala.

more **FIGHT** for

F 84 G
F 84 F
RF 84 F
F 86 H



read how the **KIDDE** Compressor makes pneumatics work at amazingly high altitudes



More fight for planes in flight is provided by the new Kidde 4-Stage Compressor . . . auxiliary power that is more reliable, more foolproof than ever before.

Think of it! The very space you fly through becomes your reservoir of pneumatic power. The supply is literally unlimited. The new Kidde 4-Stage Compressor is currently being installed aboard such fighter planes as the F-84 and F-86.

Its unusually light weight and reliable performance make the Kidde 4-Stage Compressor the perfect "workhorse" for your aircraft, too.

Why not write and let a Kidde engineer give you full information on Kidde pneumatic devices.

Kidde Walter Kidde & Company, Inc.

910 Main Street, Bellerose 6, N. Y.

Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

1

President Drops Hint Of Air Power Increase

First hint that the Republican Administration was changing its attitude on the air power defense budget was dropped by President Eisenhower last week, in a speech at Boston. The President stated that no defense sacrifice, "no labor, no life, no service" is too great for America to bear against enemies of freedom "equipped with the most terrible weapons of destruction."

This hint, coupled with word in Washington that the President is planning a serious study of the defense situation in light of Russian atomic and hydrogen bomb progress, is being interpreted by Washington observers to mean an attempt to reverse the Republican trend of heavily slashing the military air power budget (AVIATION WEEK Sept. 3, p. 13). It also is expected to touch off a bitter intra-party battle between the advocates of the balanced budget, atom-cutbacks and those in the Administration who believe it must face squarely the reality of the growing Russian capability to deliver hydrogen and atomic bomb attacks directly on American population centers.

Meanwhile, indications from the Pentagon are that preliminary fiscal 1955 budget planning is being done on a basis of still further reductions in military air power. Preliminary Pentagon budget estimates for fiscal 1955 were due at the Budget Bureau Sept. 15, but at present time last week they had not yet appeared. Now is there any indication of trends taken by the current reevaluation of the U. S. military program now under way as the Joint Chiefs of Staff.

Domestic

Donald C. McGraw is the new president of McGraw-Hill Publishing Co., succeeding his brother, the late Curtis W. McGraw. From his direction as president, Donald McGraw was vice president for manufacturing and general services. He has been a director since 1935 and vice president since 1945. A native of Madison, N. J., he is the youngest son of the late James H. McGraw, Sr., founder of the company. He attended Princeton University, served with the Navy in World War I. He was a contributor to the Publishing and Printing Division of the War Production Board during World War II.



INSPECTION BOARD SEES CESSNA TWIN-JET

USAF inspection board recently observed the first positive record of the readiness of the Cessna T-37 twin-jet intermediate utility trainer at Cessna's Wichita plant. The

Other officers of the McGraw-Hill Publishing Co. were also exchanged.

New airways plan adopted by Civil Aeronautics Administration would slash some airline traffic from 1,500 miles to new VHF airways (VOR) "Wet" network by 1960, says in the partially completed VOR system with VHF radio work in ILS facilities, visual aids (VAB) and low frequency radio beacons. Proposed by Air Transport Assn., the plan will extend VOR service into terminal area and make possible new VOR lines.

Suspension of revocation of U. S. Airframe's cargo certificate is recommended by the Civil Aeronautics Board. CAB attorneys charge the airline suspended operation of its earth-to-air service, failed to report the arrest, and flew passenger instead of cargo aircraft.

Robert W. Carr is new Deputy Assistant Secretary of Defense for Research and Development.

Airline plexicon from countries allied with the Federal Aviation Agency International will be housed at a hangar in Washington's McPherson Hotel Oct. 14, 4th anniversary of FAI. The display will be sponsored by the National Aeronautics Assn. as part of this year's celebration of half a century of powered flight.

Cessna F-102 will begin flight tests on Edwards AFB, Calif. More than 500 employees of the corporation's

San Diego Division will be assigned to the project.

International

Neddy Dole, RAF squadron leader and test pilot, used a Hawker Hunter over a 100-kilometer (62 mi) course at an average speed of 709.2 mph. Sept. 18, since Duxford, England, setting the record since of 695.113 mph, set Sept. 1 by USAF Brig. Gen. J. S. Halperin and the official mark of 552.55 mph made May 15 by Jacqueline Cochran. Dole needed a Hunter to a new three-kilometer record of 727.8 mph. Sept. 7 (Aviation Week, Sept. 14, p. 15). Both speed runs will next be confirmed by Fédération Aéronautique Internationale.

British Overseas Airways Corp. reports a net deficit of \$519,000 for the fiscal year ended Mar. 31, compared with a net profit of \$750,000 for the previous 12 months period. Operating profit at \$290,000 from revenues totaling \$101,116,000 was wiped out after payment of interest on issued capital. Last current operations closed 955,000.

Australian National Airways has purchased two DC-4s and two space to come from San Francisco for \$400,000. The airline has also ordered two of the transports from Douglas Aircraft Co.

Japan Air Lines has taken delivery on its first DC-6B, expects to receive new route by the end of next month to show start of Tokyo-San Francisco flight in Dec. 1.

No room for guesswork HERE

complete modern laboratories make sure that **FLEXON BELLOWS** will meet your requirements

The mass spectrometer pictured above is only one of the modern devices used by Flexonics Corporation to verify the high quality of FLEXON BelloWS and give assurance that they will meet your specifications. This laboratory background coupled with belloWS manufacturing skill provides a complete service to all manufacturers who use belloWS in their products.

FLEXON Stainless Steel BelloWS and BelloWS Assemblies are widely used in many types of civilian and military aircraft... have been proved in thousands of hours of tough flight service. They are made in a complete range of sizes, single and multiple ply.

For complete information and recommendations, send an outline of your needs.

Flexonics Corporation AIRCRAFT DIVISION 1302 S. THIRD AVENUE • MAYWOOD, ILLINOIS

FORMERLY CHICAGO METAL HOSE CORPORATION

In Canada: Flexonics Corporation of Canada, Ltd., Toronto, Ontario

Flexonics Corporation is a subsidiary of Flexonics Corporation, Inc. (a public company) with over 100 plants.



Flexonics metal hose



Expansion joints

Aircraft components



Stainless steel



The FLEXON BelloWS Design Guide gives full information on FLEXON BelloWS as well as useful data on selection of belloWS. Write for a copy.

SEND FOR BULLETIN



THERE'S A BIG DIFFERENCE



...in Clamps, too!



The big difference in clamps used in the fabrication of sheet metal riveted and welded sections of aircraft is precision. Monogram 3-II Safety Clamps are precision-made to do a precision job and offer many big advantages.

- Needles always uniform.
- Needles maintain true alignment.
- Greater spring tension.
- One piece construction.
- Safe, will not fly apart.
- Stronger, last longer.
- Proven in 12 years use.

Write today for catalog on the many types and sizes of Monogram 3-II Clamps and applying tools.

MONOGRAM

MANUFACTURING COMPANY

5357 Highways Street, Culver City, California

3H SAFETY CLAMPS

The Aviation Week

September 28, 1953

Headline News

RAF Heads for E. B. Test Center	10
English Flying Boat Crashed by Flood	14
Anglo-Cans Agree AF Build Dollars	14
English Delivery	15
RAF, British Overseas Comm. Deal	15
Jet Fuel Demand Nears Anglo Market	16
Security Situation Jet Fuel Debate	17
Post Office Service Almost Experiment	19
Hilly Gets License For Demon Capable	20
RAF's Comet Makes Second Flight	21
Civil Launch Shipment Services	22
Jet Crash Angers Van Days Residents	22
Five Engines Berlin Air Project Stays	24
SEC Reports Stock Transactions	24

Production

AMC to Test All Magnesium F-80C	25
Planes Aid in U.S. Conversion	25
Aviation Union Joins for Wage Talks	25

Aeronautical Engineering

Flight Is Cut as New Pilgrim Begins	41
British Project to Power Captain	42

Aeronics

Single Computer Controls Flight Data	45
RAF's Standard Panels	47

Equipment

Reentry Vehicle Designing Improved	51
------------------------------------	----

Financial

Airline Dividends For First Half	55
----------------------------------	----

Air Transport

New Schedule, Safety Barriers For Cans	59
Air Fares to Fly Chicago-Pittsburgh	60
CAB Kicks Standard Flight Restrictions	60
Boeing Industry Checks 1953-54	61
L. A. Fares Air Route Agreements	65

Editorial

After Midway	66
--------------	----

Departments

New Design	7
Feature Page	8
Industry Observer	10
What's Where	10
RAF's Co-ordinator	11
Navy Comments	12
Off the Line	13
New Aircraft Products	14
Also on the Market	15
CAB Orders	16
Shortcuts	17
Cockpit Viewpoint	18
Aviation Calendar	19

Picture Credits

1—Owen, 10—11—12—13—14—15—16—17—18—19—20—21—22—23—24—25—26—27—28—29—30—31—32—33—34—35—36—37—38—39—40—41—42—43—44—45—46—47—48—49—50—51—52—53—54—55—56—57—58—59—60—61—62—63—64—65—66—67—68—69—70—71—72—73—74—75—76—77—78—79—80—81—82—83—84—85—86—87—88—89—90—91—92—93—94—95—96—97—98—99—100—101—102—103—104—105—106—107—108—109—110—111—112—113—114—115—116—117—118—119—120—121—122—123—124—125—126—127—128—129—130—131—132—133—134—135—136—137—138—139—140—141—142—143—144—145—146—147—148—149—150—151—152—153—154—155—156—157—158—159—160—161—162—163—164—165—166—167—168—169—170—171—172—173—174—175—176—177—178—179—180—181—182—183—184—185—186—187—188—189—190—191—192—193—194—195—196—197—198—199—200—201—202—203—204—205—206—207—208—209—210—211—212—213—214—215—216—217—218—219—220—221—222—223—224—225—226—227—228—229—230—231—232—233—234—235—236—237—238—239—240—241—242—243—244—245—246—247—248—249—250—251—252—253—254—255—256—257—258—259—260—261—262—263—264—265—266—267—268—269—270—271—272—273—274—275—276—277—278—279—280—281—282—283—284—285—286—287—288—289—290—291—292—293—294—295—296—297—298—299—300—301—302—303—304—305—306—307—308—309—310—311—312—313—314—315—316—317—318—319—320—321—322—323—324—325—326—327—328—329—330—331—332—333—334—335—336—337—338—339—340—341—342—343—344—345—346—347—348—349—350—351—352—353—354—355—356—357—358—359—360—361—362—363—364—365—366—367—368—369—370—371—372—373—374—375—376—377—378—379—380—381—382—383—384—385—386—387—388—389—390—391—392—393—394—395—396—397—398—399—400—401—402—403—404—405—406—407—408—409—410—411—412—413—414—415—416—417—418—419—420—421—422—423—424—425—426—427—428—429—430—431—432—433—434—435—436—437—438—439—440—441—442—443—444—445—446—447—448—449—450—451—452—453—454—455—456—457—458—459—460—461—462—463—464—465—466—467—468—469—470—471—472—473—474—475—476—477—478—479—480—481—482—483—484—485—486—487—488—489—490—491—492—493—494—495—496—497—498—499—500—501—502—503—504—505—506—507—508—509—510—511—512—513—514—515—516—517—518—519—520—521—522—523—524—525—526—527—528—529—530—531—532—533—534—535—536—537—538—539—540—541—542—543—544—545—546—547—548—549—550—551—552—553—554—555—556—557—558—559—560—561—562—563—564—565—566—567—568—569—570—571—572—573—574—575—576—577—578—579—580—581—582—583—584—585—586—587—588—589—590—591—592—593—594—595—596—597—598—599—600—601—602—603—604—605—606—607—608—609—610—611—612—613—614—615—616—617—618—619—620—621—622—623—624—625—626—627—628—629—630—631—632—633—634—635—636—637—638—639—640—641—642—643—644—645—646—647—648—649—650—651—652—653—654—655—656—657—658—659—660—661—662—663—664—665—666—667—668—669—670—671—672—673—674—675—676—677—678—679—680—681—682—683—684—685—686—687—688—689—690—691—692—693—694—695—696—697—698—699—700—701—702—703—704—705—706—707—708—709—710—711—712—713—714—715—716—717—718—719—720—721—722—723—724—725—726—727—728—729—730—731—732—733—734—735—736—737—738—739—740—741—742—743—744—745—746—747—748—749—750—751—752—753—754—755—756—757—758—759—760—761—762—763—764—765—766—767—768—769—770—771—772—773—774—775—776—777—778—779—780—781—782—783—784—785—786—787—788—789—790—791—792—793—794—795—796—797—798—799—800—801—802—803—804—805—806—807—808—809—810—811—812—813—814—815—816—817—818—819—820—821—822—823—824—825—826—827—828—829—830—831—832—833—834—835—836—837—838—839—840—841—842—843—844—845—846—847—848—849—850—851—852—853—854—855—856—857—858—859—860—861—862—863—864—865—866—867—868—869—870—871—872—873—874—875—876—877—878—879—880—881—882—883—884—885—886—887—888—889—890—891—892—893—894—895—896—897—898—899—900—901—902—903—904—905—906—907—908—909—910—911—912—913—914—915—916—917—918—919—920—921—922—923—924—925—926—927—928—929—930—931—932—933—934—935—936—937—938—939—940—941—942—943—944—945—946—947—948—949—950—951—952—953—954—955—956—957—958—959—960—961—962—963—964—965—966—967—968—969—970—971—972—973—974—975—976—977—978—979—980—981—982—983—984—985—986—987—988—989—990—991—992—993—994—995—996—997—998—999—1000—1001—1002—1003—1004—1005—1006—1007—1008—1009—1010—1011—1012—1013—1014—1015—1016—1017—1018—1019—1020—1021—1022—1023—1024—1025—1026—1027—1028—1029—1030—1031—1032—1033—1034—1035—1036—1037—1038—1039—1040—1041—1042—1043—1044—1045—1046—1047—1048—1049—1050—1051—1052—1053—1054—1055—1056—1057—1058—1059—1060—1061—1062—1063—1064—1065—1066—1067—1068—1069—1070—1071—1072—1073—1074—1075—1076—1077—1078—1079—1080—1081—1082—1083—1084—1085—1086—1087—1088—1089—1090—1091—1092—1093—1094—1095—1096—1097—1098—1099—1100—1101—1102—1103—1104—1105—1106—1107—1108—1109—1110—1111—1112—1113—1114—1115—1116—1117—1118—1119—1120—1121—1122—1123—1124—1125—1126—1127—1128—1129—1130—1131—1132—1133—1134—1135—1136—1137—1138—1139—1140—1141—1142—1143—1144—1145—1146—1147—1148—1149—1150—1151—1152—1153—1154—1155—1156—1157—1158—1159—1160—1161—1162—1163—1164—1165—1166—1167—1168—1169—1170—1171—1172—1173—1174—1175—1176—1177—1178—1179—1180—1181—1182—1183—1184—1185—1186—1187—1188—1189—1190—1191—1192—1193—1194—1195—1196—1197—1198—1199—1200—1201—1202—1203—1204—1205—1206—1207—1208—1209—1210—1211—1212—1213—1214—1215—1216—1217—1218—1219—1220—1221—1222—1223—1224—1225—1226—1227—1228—1229—1230—1231—1232—1233—1234—1235—1236—1237—1238—1239—1240—1241—1242—1243—1244—1245—1246—1247—1248—1249—1250—1251—1252—1253—1254—1255—1256—1257—1258—1259—1260—1261—1262—1263—1264—1265—1266—1267—1268—1269—1270—1271—1272—1273—1274—1275—1276—1277—1278—1279—1280—1281—1282—1283—1284—1285—1286—1287—1288—1289—1290—1291—1292—1293—1294—1295—1296—1297—1298—1299—1300—1301—1302—1303—1304—1305—1306—1307—1308—1309—1310—1311—1312—1313—1314—1315—1316—1317—1318—1319—1320—1321—1322—1323—1324—1325—1326—1327—1328—1329—1330—1331—1332—1333—1334—1335—1336—1337—1338—1339—1340—1341—1342—1343—1344—1345—1346—1347—1348—1349—1350—1351—1352—1353—1354—1355—1356—1357—1358—1359—1360—1361—1362—1363—1364—1365—1366—1367—1368—1369—1370—1371—1372—1373—1374—1375—1376—1377—1378—1379—1380—1381—1382—1383—1384—1385—1386—1387—1388—1389—1390—1391—1392—1393—1394—1395—1396—1397—1398—1399—1400—1401—1402—1403—1404—1405—1406—1407—1408—1409—1410—1411—1412—1413—1414—1415—1416—1417—1418—1419—1420—1421—1422—1423—1424—1425—1426—1427—1428—1429—1430—1431—1432—1433—1434—1435—1436—1437—1438—1439—1440—1441—1442—1443—1444—1445—1446—1447—1448—1449—1450—1451—1452—1453—1454—1455—1456—1457—1458—1459—1460—1461—1462—1463—1464—1465—1466—1467—1468—1469—1470—1471—1472—1473—1474—1475—1476—1477—1478—1479—1480—1481—1482—1483—1484—1485—1486—1487—1488—1489—1490—1491—1492—1493—1494—1495—1496—1497—1498—1499—1500—1501—1502—1503—1504—1505—1506—1507—1508—1509—1510—1511—1512—1513—1514—1515—1516—1517—1518—1519—1520—1521—1522—1523—1524—1525—1526—1527—1528—1529—1530—1531—1532—1533—1534—1535—1536—1537—1538—1539—1540—1541—1542—1543—1544—1545—1546—1547—1548—1549—1550—1551—1552—1553—1554—1555—1556—1557—1558—1559—1560—1561—1562—1563—1564—1565—1566—1567—1568—1569—1570—1571—1572—1573—1574—1575—1576—1577—1578—1579—1580—1581—1582—1583—1584—1585—1586—1587—1588—1589—1590—1591—1592—1593—1594—1595—1596—1597—1598—1599—1600—1601—1602—1603—1604—1605—1606—1607—1608—1609—1610—1611—1612—1613—1614—1615—1616—1617—1618—1619—1620—1621—1622—1623—1624—1625—1626—1627—1628—1629—1630—1631—1632—1633—1634—1635—1636—1637—1638—1639—1640—1641—1642—1643—1644—1645—1646—1647—1648—1649—1650—1651—1652—1653—1654—1655—1656—1657—1658—1659—1660—1661—1662—1663—1664—1665—1666—1667—1668—1669—1670—1671—1672—1673—1674—1675—1676—1677—1678—1679—1680—1681—1682—1683—1684—1685—1686—1687—1688—1689—1690—1691—1692—1693—1694—1695—1696—1697—1698—1699—1700—1701—1702—1703—1704—1705—1706—1707—1708—1709—1710—1711—1712—1713—1714—1715—1716—1717—1718—1719—1720—1721—1722—1723—1724—1725—1726—1727—1728—1729—1730—1731—1732—1733—1734—1735—1736—1737—1738—1739—1740—1741—1742—1743—1744—1745—1746—1747—1748—1749—1750—1751—1752—1753—1754—1755—1756—1757—1758—1759—1760—1761—1762—1763—1764—1765—1766—1767—1768—1769—1770—1771—1772—1773—1774—1775—1776—1777—1778—1779—1780—1781—1782—1783—1784—1785—1786—1787—1788—1789—1790—1791—1792—1793—1794—1795—1796—1797—1798—1799—1800—1801—1802—1803—1804—1805—1806—1807—1808—1809—1810—1811—1812—1813—1814—1815—1816—1817—1818—1819—1820—1821—1822—1823—1824—1825—1826—1827—1828—1829—1830—1831—1832—1833—1834—1835—1836—1837—1838—1839—1840—1841—1842—1843—1844—1845—1846—1847—1848—1849—1850—1851—1852—1853—1854—1855—1856—1857—1858—1859—1860—1861—1862—1863—1864—1865—1866—1867—1868—1869—1870—1871—1872—1873—1874—1875—1876—1877—1878—1879—1880—1881—1882—1883—1884—1885—1886—1887—1888—1889—1890—1891—1892—1893—1894—1895—1896—1897—1898—1899—1900—1901—1902—1903—1904—1905—1906—1907—1908—1909—1910—1911—1912—1913—1914—1915—1916—1917—1918—1919—1920—1921—1922—1923—1924—1925—1926—1927—1928—1929—1930—1931—1932—1933—1934—1935—1936—1937—1938—1939—1940—1941—1942—1943—1944—1945—1946—1947—1948—1949—1950—1951—1952—1953—1954—1955—1956—1957—1958—1959—1960—1961—1962—1963—1964—1965—1966—1967—1968—1969—1970—1971—1972—1973—1974—1975—1976—1977—1978—1979—1980—1981—1982—1983—1984—1985—1986—1987—1988—1989—1990—1991—1992—1993—1994—1995—1996—1997—1998—1999—2000—2001—2002—2003—2004—2005—2006—2007—2008—2009—2010—2011—2012—2013—2014—2015—2016—2017—2018—2019—2020—2021—2022—2023—2024—2025—2026—2027—2028—2029—2030—2031—2032—2033—2034—2035—2036—2037—2038—2039—2040—2041—2042—2043—2044—2045—2046—2047—2048—2049—2050—2051—2052—2053—2054—2055—2056—2057—2058—2059—2060—2061—2062—2063—2064—2065—2066—2067—2068—2069—2070—2071—2072—2073—2074—2075—2076—2077—2078—2079—2080—2081—2082—2083—2084—2085—2086—2087—2088—2089—2090—2091—2092—2093—2094—2095—2096—2097—2098—2099—2100—2101—2102—2103—2104—2105—2106—2107—2108—2109—2110—2111—2112—2113—2114—2115—2116—2117—2118—2119—2120—2121—2122—2123—2124—2125—2126—2127—2128—2129—2130—2131—2132—2133—2134—2135—2136—2137—2138—2139—2140—2141—2142—2143—2144—2145—2146—2147—2148—2149—2150—2151—2152—2153—2154—2155—2156—215

INDUSTRY OBSERVER

► Romanovs or Soviet has equipped its first combat group with new long-range turboprop bombers (Aircraft Week Aug. 13, p. 11). Known previously as the Tupe 33 or Tu75, 18 of these planes have been assigned to three squadrons now stationed at northern Siberia—possibly on one of the new airfields in Krasnoyarsk, 1,700 mi. across the Arctic Circle from New York.

► Russian sources have confirmed production of a new transport version of the B-28 twin-tail bomber series (Aircraft Week May 10, p. 10). Observers behind the Ilyushin Corbin report the newtype B-28s are being in southern series, indicating that production has been under way for some time. Strength of the new wings is released at 40 tons, with wing loaded forward (as the bomber) thus in the strengthening series. Some planes have been fitted with external fuel tanks.

► U.S. aircraft officials are worried about another loss of vital jet engine information from British confidants at commercial versions of the Rolls-Royce Avon series of axial-flow turbines. The R.A.5, rated at 4,500 B. thrust, already has been sold to British airlines via the Comet 3 jet transport and the civil version of the 30,000-hp Avon R.A.14 will be available to Transavia in the Comet 3. The R.A.14 currently is Britain's best military turboprop. U.S. officials feel strongly that the Russians do not yet have a good axial-flow turboprop and would be anxious to buy the secrets of Rolls-Royce. Engines now used in the MIG-15 were developed from centrifugal-flow Rolls-Royce Nene and Derwent turboprops sold to Russia in 1947 by the British.

► General Electric's motor aircraft engine project has been moved to the status of a department under the firm's Aircraft Products Division. Dr. R. Shanks, a pioneer in U.S. jet development, continues to head the project. The thrust engine was formerly under the jurisdiction of GE's Gas Turbine Division.

► Aircraft is building brand-new integral takeoff root units for USAF B-47 now uses H solid propellant Btu units for takeoff boost.

► Conquest-Wright avionics will test a Bristol Olympus in a B-28 flying test bed to check some methods developed for the B-7, C-W's version of the engine which has design features of the subsonic Olympus and is similar to considerably higher thrust than current versions of the Bristol engine. The B-7 is scheduled for advanced versions of the Conquest F-802.

► French Helicopter Corp. has terminated its subcontract with Gendyne for building 1171 helicopters. Paveco plans to build its own helicopters at its Morton, Pa., plant.

► Navy has given General Electric a contract to develop a new turboprop engine in delivery about 500 ships.

► British European Airways is considering a special airframe version of the Vulcan B1 Super-Vulcan. BEA chairman Sir Michael recently disclosed to a parliamentary committee. BEA has 12 Super-Vulcans on order with an option for another eight. Deliveries are expected in 1955-56.

► Current costs of new British jet transports recently were estimated by BEA and BOMC for a parliamentary committee as follows: Comet 3, \$770,000; Comet 2, \$1.4 million; Comet 3, \$2.1 million; Britannia, \$4.6 million; Viscount 701, \$700,000; Viscount 800, \$794,000. All prices include an initial provision of spares.

► De Havilland expects to complete final design of its Comet 3 jet transport in October after U.S. Civil Aeronautics Administration officials have had a chance for a final evaluation of the de Havilland proposal.

► USAF expects to lift the security wraps from the North American F-100 supersonic fighter and the Pratt & Whitney J75 18,000-hp-thrust turbo-propeller turboprop of the Air Force Light two engine test engine.

WHO'S WHERE

In the Front Office

Ernest G. Leffler, Jr., has been appointed president and general manager of Century Controls Corp., Farmingdale, N. Y., specialists in design, development and production of electronic control systems and accessories for aircraft. He formerly was with Wright Aeronautical and Stuart Division of Fairchild.

Edith M. Cassiday has been named assistant vice president/development of the Glenn L. Martin Co. He came to GLM from TWA when he was named.

Ernest G. Tompkins, technical director of Federal Telecommunications Laboratories, Melrose, N. J., has been designated a vice president and member of the firm's new aircraft laboratory board.

Mauro Pichler, Jr., has been elected president of Pfaff Mfg. Co., Chicago, 33 aircraft hardware firm.

Changes

Frank Moran has been appointed sales manager/contract manager for Conquest Aircraft Co., Wichita, Robert E. Lutz is now director of procurement and support.

Earl L. Wadsworth has been designated technical head of turbine development group of Cook Research Laboratories Division, Cook Electric Co., Chicago, Ill. Alfred D. Anderson has been named chief engineer of the research laboratories.

James F. DeLo, formerly with Hamilton Standard, has joined Eldec Ship Net Corp., of Ansonia, Conn., N. J., to take and assist in the general sales manager.

Ronald H. Fayer has been named director, aircraft engineering for Avco, Woodbridge, N. Y., maker of aircraft structural test cell systems.

William F. Gerlach, for almost eight years aviation writer for the London Free Press, has been designated information officer of the Air Industries & Transport Association in Ottawa.

George J. Wadsworth has been promoted to general sales manager by Edson Burns and Division, Thomas A. Edison, Inc., West Orange, N. J.

Raymond W. Fisher has been appointed operations manager for California Eastern Airways, Inc.

Ernest Best, former San Francisco news reporter, has been named director of sales for General Aviation, with headquarters at Mechanics Field, Ft. Worth, Tex.

Honors and Elections

Dr. David G. C. Cook of RCA Laboratories is winning the Stuart Ballantine Medal of the Franklin Institute of the State of Pennsylvania for his invention of the shock-reduced radio wave.

Harold Clegg, retiring vice president of United Air Lines, was honored at a luncheon dinner by American Airlines in 1954, when at his death, 70 years in the airline industry.



HAMILTON STANDARDS... leader for years in propeller design and production, is supplying Hydromatic propellers for such outstanding aircraft as the new Douglas DC-7, turbo-compound commercial airliner.

Whatever Man Flies



Propellers • Seals • Air Conditioners • Red Controls • Auxiliary Drives • Hydromatic Pumps

HAMILTON STANDARDS, BRIDGEPORT, CONNECTICUT



AIRCRAFT

DIVISION

Serving the Aviation Industry

... as prime contractors to the United States Government and sub-contractors to Douglas, Northrop, Convair, and Lockheed. Complete nose with rocket tubes, straps, ducts and seats for the U. S. Air Force's Lockheed F-94C Starfire interceptor, pictured here, are products of Rheem.

Contact us for the answers to your production problems

RHEEM Manufacturing Company ... Aircraft Division, Downey, California



AVIATION WEEK

VOL. 58, NO. 13

SEPTEMBER 28, 1958

Fugitive MiG Heads for U.S. Test Center

• AF races to wring out Russia's top combat jet.

• Delivery is first break in three-year search.

By A. W. Joseph
(McGraw-Hill World News)

Tokyo—U. S. Air Force moved with lightning speed last week to capitalize on a big break before it could be dropped by diplomatic indifference.

No sooner had a fugitive Communist MiG-15 stopped refueling at Kampo Airfield than it was seized. USAF then speeded the Russian jet fighter to test centers in the United States.

Before any diplomatic fight over capturing the aircraft ends, the Air Force hopes to complete all information it wants on the MiG-15.

► **MIG Wanted**—American pilots have wanted to fly the top Red combat fighter since MiGs entered the Korean war more than three years ago.

They believe the jet can exceed performance claims in Korea, bring Communist pilots under disciplinary wraps or boost the know-how to wring everything out of the aircraft that is apparently the world's highest-altitude fighter.

► **Under Wraps**—USAF dropped a recently Modelized over the MiG immediately after it landed at Kampo.

Officials were not willing to reveal any details regarding its design, equipment or whether the aircraft even has an engine, although it is obvious that the enemy knows the MiG-15's technical details.

► **Early Model**—The North Korean pilot who delivered the fighter to USAF says Russian instructors flew the best and latest MiGs, including those with radar equipment, while North Koreans and Chinese piloted poorer models.

Therefore, it is possible that the MiG that was sent to the United States is an early model.

USAF to Take Wraps Off Soviet Jet

The first flyable Russian-built MiG-15 to fall into U. S. hands was scheduled to be introduced at Wright-Patterson Air Force Base, Dayton, Ohio, late last week after a 7,600-mile flight in a Douglas C-124 transport from Kampo Air Base near Seoul, Korea.

Wings and tail of the Soviet jet fighter were removed from the fuselage for transport in the C-124.

An Materiel Command source told Associated Press the MiG-15 would be reassembled at Wright-Patterson as soon as possible after arrival and made available for external observation and photographing by the press. It then will be evaluated by technical intelligence experts.

USAF sources indicated that most of the top F-86 Sabre pilots of the Korean war would fly the MiG-15 to compare it with U. S. fighter types.

Because the armistice agreement allows both sides to move aircraft back and forth provided the material does not exceed the force in Korea when the truce was signed, there is an obvious technical detail that streamlines any firm conversion.

But the charge puts a psychological burden on the Communists to prove there are not violating the agreement.

► **Red-Faced USAF**—The fugitive MiG swept through Korea to Kampo unharmed. Red-faced Far East Air Force officials strove to obtain USAF if the captured Communist jet from the bowler.

Their story was attacked when the former Red flyer revealed that he Saboteered him to Kampo.

► **Soviet Supremacy**—Officials, who wanted to escape communism either during the Civil War, First China. Otherwise, there would have been no shooting at United Nations air bases in Korea last week.

By introduction, he substantiated years of top stories in the theater that Soviet fighters are the best offensive or weapons in the world today.

► **Military Jet-Arrival** of the MiG-15 at Kampo marked the end of a three-year effort by USAF to get a flyable sample of the surprising Russian jet fighters.

The last MiG-15 appeared in combat over North Korea in the late summer of 1953, operating from Manchurian bases.

From the west flies off the Korean coast by a bomber.

USAF analysis of the MiG-15 was the basis of an exclusive article in *Aviation Week* (July 7, 1952, p. 16).

Air Force was so nervous to get a flyable version of the fighter that it usually considered having one built by an American aircraft manufacturer from drawings made from the damaged one.

► **MIG Price Tag**—The \$100,000 offer for the delivery of a MiG-15 to an Allied air base in Korea was made last spring by Gen. Mark Clark.

Two Polish pilots later even landed MiG-15s on the Danish island of Bornholm in the Baltic in an effort to escape the Communists. Neither jet was flyable after the landings, although considerable technical data was obtained from them. But Clark's offer applied only to the Korean coast border threat.

► **First Offer**—When the \$100,000 per aircraft-\$50,000 for a MiG-15 and a \$50,000 bonus for the first delivery—was published, Pentagon intelligence officials were notified of the offer made three years earlier to USAF in Europe by a Czech pilot who offered to deliver a MiG-15 intact for \$10,000 and personal services.

The Czech was a former pilot in the Luftwaffe who had flown German jets. He was employed in a civilian position at a Russian airfield in East Germany, where his duties required him to test MiG-15s from longings to fight low and dispersal areas. The jet was recovered and destroyed by a top USAF guard in Europe.

► **No Completion**—USAF and it

would pay the \$100,000 to the North Koreans who delivered the MIG-15. It is Korea because original offer were had been withdrawn. The MIG pilot will be paid from a special fund at \$51 million available to Secretary of the Air Force Harold E. Talbot.

The \$100,000 for delivery of captured MIG-15s in Korea still stands.

No international complications are anticipated by USAF over the MIG incident, because the Koreans were still in suit over officially.

Hughes Flying Boat Crushed by Flood

Harold Hughes' giant flying boat suffered damage estimated at more than \$5 million when a large earth slide burst on nearby property, splitting thousands of tons of mud, soil and water into the Hughes barge and dock at Terminal Island, Calif.

The flood lifted the flying boat out of its dry dock and crushed it against an adjacent structure and the barge. A company spokesman says Hughes and his engineers believe it would be eight to nine months of a year to repair the damage.

When the deluge occurred, the giant airplane—largest in the world—was undergoing final acceptance preparation to be launched and the start of test and flight work that was scheduled for early next month.

Damage to the ship included both the hull, a tail fin and stabilizer, stream air horizontal stabilizer, tail door, rudder tab, and the de-ice and mechanical control system.

An estimate of damage to facilities, equipment, electrical machinery, fixtures, records, blueprints and other equipment has not been made yet. It will require weeks to remove the muds deposited by the flood throughout the flying boat building area.

Temco Builds Trainer For Navy Contest

Temco Aircraft Corp. won a contract order of a new primary basic military trainer—designed, manufactured and flown at the Dallas plant in 75 days—by Navy's design competition for a replacement for the SN-1.

Powered by a 225-hp Continental engine, the new Model 35 Pilot is a two-seat trainer, low wing monocoque with a two-level landing gear and power operated four-blade bubble canopy.

Temco says the trainer will weigh 1,750 lbs. carrying a gross weight of 2,000 lbs. at sea level, has a top speed of 180 mph., cruises at 171 mph. and has a cruise (gross weight) in 33,700 ft. only a 608 mi.



CANCELLATION of jet engine orders was measured by Defense Secretary Charles Wilson (left) and Air Force Secretary Harold E. Talbot (right). In the background, Gen. Cyril R. Cook, USAF Deputy Chief of Staff (Military), looks on as Wilson discusses the cancellations.

Engine Cuts Save AF Half Billion

Reductions result from longer life of turbojets and an oversupply of powerplants in Air Force stockpiles.

By Richard Bakeman

Long-lived turbojets engine with the recent realization of the engine industry's present program have been ordered that the Air Force to reduce its future engine requirements.

A cutback of an old-fashioned engine—now already cancelled for, unless only programmed—has been ordered that will save the USAF from \$400 to \$100 million.

The new cut is predicted (Aircraft Week, Aug. 31, p. 14) after weeks of study and review of the engine program. It followed a recent study of the current program (Aircraft Week, Sept. 18, p. 18) which resulted in a substantial engine cutback.

New Requirements—Final details of the cutback have not crystallized. But Air Secretary Harold E. Talbot says that USAF's action is not an emergency but a long-term plan to reduce the present stock of 145 units.

Chief reason for an engine cutback at this time, Talbot explained, is the fact that present jet engines are as much better than cancelled. Also the Air Force is accumulating a large stockpile of new jets and old jet engines around the world the more that will be needed.

"We're got an oversupply of jet engines," he said. "I saw them in Moscow. I saw them in France, and I saw them

in every depot you go into. You are just stacks of jet engines."

The Pentagon—Two factors dominating the picture are those, he pointed out. "A much greater time between overhaul is now being realized from our jet engines. This greater time is a result of an accelerated know-how to operate jet engines, better manufacturing methods, improved design of our engines, and increased maintenance capability."

"We have decreased our attrition rates. This reduction is due partly to the decrease in the flying hours program which is the order of our present training. Our accident rate has been reduced, and we are saving money in our operations for these engines."

There was no outline in the original jet engine order," he said. "We had no experience in terms of what, in a 100-hour time between overhaul, in the experience of our engines. Actual use of the engines, however, has been given to the Korean Air Force, has been given to our Air Force on which to base engines."

CE Head H-1—Headed by the Air Force in General Electric. The latest number of engines cancelled were C-141's which were the B-47 Stratojet and F-105 Sabre. Board's how many will be cancelled is not known yet. USAF earlier had cancelled orders for 360

thousand J45s at GE, Stouffer and Packard.

Exactly every compensating and jet engine USAF now is buying will be affected in the cutback, except the Pratt & Whitney J57, production of which will be increased at P&W's East Hartford, Conn., plant.

Ford Motor Co. is looking to produce the J57 at its Chicago plant where it now is building the F4U R4360.

In line with the engine program to match the recently cancelled aircraft programs, Air Force will have to cut the Curtiss-Wright 365 Sapphire engine which powers the Republic F-84F. More than 100 of these supersonic fighters and the North American F-86F's were not cut to enable Air Force to recover orders for NA F-100, McDonnell F-101 and the Republic F-105.

Each of these fighters, except the F-105, will be powered by the Pratt & Whitney J57. The F-105 gets the A1A engine J71.

►B-47 Cutback—At the same time USAF cut B-47 fighters it cancelled 151 B-47s from its current program. This cutback, coupled with the increased life expectancy of the engines, reduced USAF's requirement for the engine considerably. Some J47s are now going 1,800 hr. between overhauls when they were estimated originally at 100 hr.

Two GE plants affected will be Lockheed in Cincinnati and the West Lynn, Mass. plant.

►Second Sources—Aide from prime sources affected such as General Electric, Air Force will phase out its contracts in considerable numbers, such as:

►Stoddard, building the J47 at South Bend, Ind.

►Nash, building F4U R4360 at Kenosha, Wis.

►Packard, building the J47 at Detroit, Mich.

►Beech, building the J45 at Flint, Mich.

►Chrysler, building the Wright R3350 at Toms River, N. Y.

Talbot said these license firms may complete production of their engines under their own plans or they may be sold to other companies.

►Offen Case—Talbot said the J57 is the engine we are relying on. He called it Air Force's future engine.

The Alumn J51, which powered the Lockheed F-94, F-84 and F-51, will also be affected by the cutback. Of the series, 141 have already been cut by USAF earlier when it cancelled its own production program. Respondent says Wright R3350s and F4U R4360s are on list.

Defense Secretary Charles Wilson said the engine order is being "put

like ordering a pound of beefsteak and finding you only want a half pound that will cost you \$6, not \$10, and being told 'hangry' we might be for these engines, we ordered more engines than we could cut on our maintenance and service program. We don't cut them up on the engine."

Talbot agreed engine manufacturers on generally for the "considerable studies that have been made on the development of jet engines in the last five and three years. The manufacturers have done a significant job and the engines have gotten better and better."

►Wilson, Consultant—Wilson, quoted former President Truman in remarks to the Congress, What said the opportunity was about the engine cut.

"I understood the case and that if you can't stand the heat, you'd better stay out of the kitchen and let some body else do the cooking."

When a contract is the new one, do nothing, if it happens to use money, they'll bloody money. These figures have been prepared in the Air Force, not authorized by me or the Department of Defense. I understand what the Air Force thinks they are going to do. This changed program we still have not affected our plans in the production of one plane, and after all, you engine is a part of the plane."

Along with the cutback, USAF is seeking a new plan for increasing emphasis on development and production of turbojet engines. So far the emphasis is only in development stage. USAF says the Navy's engine (Aircraft Week, May 23, p. 18, June 28, p. 44) Accompanying Talbot to Los Angeles were Undersecretary Roger Lewis and Lt. Gen. Cyril Cook, USAF Deputy Chief of Staff.

An official said "The defense programs were being affected by the operational needs."

Hughes products for combat systems for all of the USAF's current activities, one of the Navy's and the Air Force CY-101 is developing advanced designs for major interceptors like the Convair F-105. The company also developed the F-105, which is believed to be in production.

►First Indication—First public indication of the deal between Hughes and H&C was made when the deal was announced on Sept. 17 that Dr. Kenneth Woodbridge had quit Hughes to lead a new in-house company, the Remo-Woodbridge Corp., organized by Thompson Products, Inc. of Cleveland, Ohio. The new Remo-Woodbridge announced the resignation of Gen. George.

Kearns and Woodbridge were the two top scientists at H&C and had been with the company since 1946 when it first entered the industry and guided

Hughes Blowup

- Six top officials quit in protest of owner policies.
- Talbot intervenes but fails to halt walkout.

At least six top officials of Hughes Aircraft Co., one of the world's largest weapons producers and a major contributor to the country's air defense program, have quit the company in protest against the policies of Harold Hughes, main shareholder owner of the company. William W. Wilson, Hughes' executive vice president, says that officials have indicated they will resign.

The officials, five of them vice presidents, include Gen. Harold L. George, general manager, Dr. Norma Green, chief of operations, Dr. Dean Woodbridge, head of the Hughes Laboratories, Dr. R. C. Johnson, head of the Hughes Aircraft Co., and Dr. R. B. Pridmore, manager of manufacturing.

►Strategic—George-Gentry of the Air Force in USAF is evidenced by heretofore made by Secretary of the Air Force Harold E. Talbot in Los Angeles in an attempt to forestall the resignation of the men who, in his view, had helped build the company from a small experimental research outfit to a \$200-million-a-year concern producer (Aircraft Week, May 23, p. 18, June 28, p. 44) Accompanying Talbot to Los Angeles were Undersecretary Roger Lewis and Lt. Gen. Cyril Cook, USAF Deputy Chief of Staff.

An official said "The defense programs were being affected by the operational needs."

Hughes products for combat systems for all of the USAF's current activities, one of the Navy's and the Air Force CY-101 is developing advanced designs for major interceptors like the Convair F-105. The company also developed the F-105, which is believed to be in production.

►First Indication—First public indication of the deal between Hughes and H&C was made when the deal was announced on Sept. 17 that Dr. Kenneth Woodbridge had quit Hughes to lead a new in-house company, the Remo-Woodbridge Corp., organized by Thompson Products, Inc. of Cleveland, Ohio. The new Remo-Woodbridge announced the resignation of Gen. George.

Kearns and Woodbridge were the two top scientists at H&C and had been with the company since 1946 when it first entered the industry and guided

XH-17 Canceled

The large turbojet-powered Hughes Aircraft XH-17 helicopter, and its larger successor, the XH-25, have been canceled as the Air Force pursues more radical.

Nathaniel Stiefen, formerly chief of the Hughes Helicopter Division, has joined American Helicopter Co.

enables fields. Both are seen of considerable status in the industry and was instrumental in starting some of the top executives now at Hughes.

(The Hughes President, who first entered the electronics field in 1936, holds a stock interest in the newly formed companies. Workbridge is president and Kuno is vice president and executive director.)

■ **Long Hauling**—The situation which led to the build is believed to have been brewing for some time and is not directly related to Hughes' earlier setbacks in the company. Kuno's terms reportedly have been a "black box" but at least several times. Each was submitted individually, American Waco was told, with no attempt at collective action.

So much for Noah Dietrich, executive vice president of Hughes Tool Co., took over control of Hughes Aircraft, apparently by buying Gen. In Baker, who has been chief liaison officer between the two companies.

On Sept. 21, Hughes reportedly met with company officials at a lunchtime session which lasted from 9:30 p.m. to 1:30 a.m. but to no avail.

Disaffection over Hughes' plans for the company's future is believed to have motivated HIAAC management. There was consultation with American Waco, when, when the company's executive staff went forward, top HIAAC management reportedly admitted that all that they knew about the move was "what they said in the press." American Waco was told that Hughes officials for management reasons were not involved.

■ **Company Failure**—Despite their own official denials, officials are reportedly aware of how close the people to remain with the company to continue to work on a day-to-day basis. A retirement officials explain that by using that they feel considerable pride in the operation which they built up and are reluctant to see their efforts dissipated.

C-124s on Pacific Airfield

Air Force is operating six C-124s on regularly scheduled trans-Pacific airlift flights, orders to add more C-124s to the Air Force fleet in the future.

Hurley's Views on New Transports

Don't Sell Piston Power Short

Another round of reciprocating engine airliners will precede turboprop era in U. S., C-W president predicts.

The U. S. airline industry will buy another round of piston-powered transports before entering the gas turbine era by switching to turboprops, Ray Hurley, president and chairman of the Curtis-Wright Corp., predicted to Aviation Week last week.

Hurley and additional commitments to the compound piston engine and reformers in current turbine designs would enable airlines to operate a mix of transport aircraft schedules in areas where with piston-powered equipment. American Airlines recently announced the beginning of an eight-hour transport-instrumental schedule with Douglas DC-7s powered by Wright R3500 Turbo Compound piston engines.

■ **Counter Economy**—Airlines obviously will make the switch to gas turbine power with the turboprop rather than the turboprop because of the greater operating economies afforded by the turbine-driven propeller, according to Hurley. He said the propeller feed a model before in both the turbine and super sound speed ranges.

In fact, in a speech before the Aviation Club of Washington, Hurley said the major problem being aviation today is the growing disparity between the increasing complexity of modern aircraft and the capacity of the aircraft industry to produce them in sufficient quantities and at a reasonable cost.

■ **Wrong Philosophy**—Hurley stressed

current aircraft procurement has by checking the aircraft industry to a close eye of growth except in time of emergency.

He said that these laws were motivated by a fear that the result industry's return on net worth would get too high and would that unless this philosophy is scrapped Congress and the industry will have to accept a low rate of return on net worth as the only acceptable, consistently acceptable which they originally had wanted from the industry.

The aircraft industry should be encouraged to place back money into development of increased and more efficient piston power capacity by allowing accelerated amortization costs.

Hurley stressed that this policy would permit the aircraft firm to accept 300 cents of every dollar expended in better production capacity instead of the 100 cents on every dollar now available. Net income after taxes and dividend requirements.

■ **Frugal Slow**—Hurley and the aircraft industry had been considering making an accelerated amortization policy for three years but these had been so slow progress yet.

"The answer to aircraft industry problems doesn't lie in making more money through higher prices but in increasing costs by more efficient production," Hurley said. "The industry should be encouraged to place money back into increased productive capacity and the government can only take it out if it is converted to use the money for that purpose."

"I don't think the answer lies in a generalized sound production rate over a long period of time, either. The aircraft industry has to take its chance on delivering the right product at the right place and the right time put in any other industry does."

■ **Space and Tools**—Hurley and that with a policy of accelerated amortization costs in effect, Curtis-Wright could have provided the plant expansion required by the Korean emergency for a 55-million investment annually for the last five years after World War II could and a \$15-million investment annually in subsequent years.

"The goal of the aircraft industry's productive capacity expansion should be aimed at providing the plant space and tools to meet current industry requirements with a single shift 40-hour week

work, he said, and with this base increasing any future expansion could be met much faster by simply adding to a three-shift 40-hour operation without any requirement for additional plant space or tools—the two worst bottlenecks in the Korean war emergency expansion.

"If I were an owner of the United States I would keep up my own aircraft productive capacity and watch carefully the increasing separation between the complexity of our aircraft and our ability to produce them with sufficient speed in sufficient quantities. When an enemy can strike with sufficient force to inflict damage on our economic productive capacity that can't easily be recovered then he will be tempted to attack and, unfortunately for us, he would enjoy a good chance for success."

NAL Official Denies Comet Negotiations

Robert E. Walcott, National Airlines executive, last week said his company is interested in Comets but described as "unofficial" reports from London that he negotiated with de Havilland Aircraft Co. for 12 jet transports.

"We're interested, the same in any other airline," NAL's regional vice president New York told Aviation Week. "But there are no negotiations." "I looked at the Comet while I was in London and discussed it with de Havilland—company officials, certainly as did."

"If we ever do start negotiations, we'll be the first to admit it."

■ **IH Specified**—Deposits from London last week said that Walcott had National would pay more than \$25 million for 12 jet transports, probably Comet 2s and 3s. The reports quoted him as saying: "We think that although the Meteor I Comet would be economical for us, we would certainly like Meteor 2s and 3s. There have been some rumors by Americans about the question of delivery dates, but all I can say is that it seems the dates would suit us."

But de Havilland spokesmen told Aviation Week's London correspondent that by this decision by NAL to buy the turbine-powered lines come in a surprise to them.

■ **U. S. Jet Wanted**—A few days before the report of negotiations, C. F. Baker, president and board chairman of National indicated the airline intends to seek for a jet transport produced in the United States.

"When America's airlines are ready for jets," Baker said Sept. 15 in New York, "the obvious production methods of our manufacturers will be employed to teach the British in a hurry."



AUTOMATIC FACTORY in producing electronic, developed by Bureau of Standards for Navy, could revolutionize industry. Present plant plant is designed to make...



TINY MODULES, turbine assembly and work, at a rate of 1,000 per hour.

COMPARISON of one module construction (left) with older technique (right).

Navy Unveils Automatic Factory

The Navy Bureau of Aeronautics and the Naval Research Bureau of Standards have taken the steps of Project Tanker, the nation's first "automatic factory" for mechanical production of electronic and its related assembly fabrication techniques which could revolutionize electronics manufacturing.

During the past two weeks, top-level representatives from approximately 100 electronics and aircraft companies got their first look at the new process in a pilot plant which has been operating for several months in an obscure building near the Pentagon. Industry was impressed that Navy/NBS had projected as far as last. Evidence of the program

and the pilot plant had been a well kept secret.

Developed by NBS, with the aid of several industrial contractors, Project Tanker is viewed by the Navy as the answer to the problem of how to produce the vast quantities of electronic equipment which would be required in the event of war. The process is best adapted to large-scale production programs.

■ **Eye-Openers**—Visitors at the pilot plant saw materials going in one end of the production line and finished electronic modules, consisting of a tube and associated reaction and capacitor wiring off the other end. Instead of the

factory sight of new equipment now being produced for TV sets that can be connected with 24 hours to produce modules for military gear, Navy estimates.

At equipment stations, each module component is individually tested and tested according to tolerance established by pinpoints. Defects are discarded automatically.

Not Fully Automatic Yet—The present operation is not completely automatic. For instance, microcircuits are hand-checked from one machine to the next. However, an NBS spokesman says the objective was to mechanize only the critical assembly-testing operations. The mechanized handling techniques used on individual machines should be easy to apply to the task of transporting microcircuits between machines.

The pilot plant is presently being operated by the Navy by Kasey Electronics, an Division of Wally Motors, Inc., to shake out minor bugs and establish module manufacturing costs. Present goal is to be able to produce individual modules at a cost of 50 cents. Final output is going to be an electronic device driven through by Sanders Associates, Inc.) which will serve as a proving ground.

Technology Advantages—Navy has put almost \$5 million into the development of its present pilot plant, although a spokesman estimates the present plant now could be duplicated for around a million dollars. If Project Tinkertoy, 300-planes spread through the industry, Navy expects its investment to pay off in the following ways:

- **Lower cost.** Navy and NBS estimates Tinkertoy plant could not duplicate equipment manufacturing cost 20-25%.
- **Quick expansion.** In an emergency, plant output can be quickly expanded to 100,000 a day, 7-day shift without necessity of buying and training large numbers of new workers (Goal at present plant is 1,000 modules per hour).
- **Fast conversion.** An electronic fac-

torial producing modules for TV sets could be converted into 24 hours to produce modules for military gear, Navy estimates.

• **Uniform quality.** Elimination of manual operations and use of total inspection during manufacturing cycle should produce more uniform, higher quality product, Navy says.

• **Reduced lead time.** Because Tinkertoy plant operates largely from one unit, it could lead to cycle between component and equipment manufacturing should be eliminated, Navy says.

• **Modular Construction.** The Tinkertoy plant operation is based on turning out individual machines, 7 in size by approximately one inch long. These can contain resistors, capacitors, resistors, diodes and a miniature or sub-miniature base line, all suitable automated for the operation of one or two electronic stages. Each module may contain up to 10 resistors or capacitors, or combination thereof.

Group of Tinkertoy modules are first combined on a common module platform, may be either manual or automatic) to form a circuit of military or commercial electronic components. Individual module assembly is followed by the replacement of the particular component.

• **Complete Uniformity.** The module consists of four to six machine-made electronic units. During the manufacturing cycle, the units are sub-assembled with the accuracy of machine tools. To these are attached modules consisting of machine-made carbon-coated tape, or capacitors consisting of small ceramic capacitors which have been machine-made with silver film sections are automatically formed and secured to other ceramic wafers.

Where resistors or diodes are required, conventional components can be used and machine-mounted on a ceramic wafer. All wafers prepared for a single module are assembled by a machine which utilizes a new litho-

graph using the four edges of the wafer. The better work serves both as a mechanical support and an electrical interconnection between individual units.

• **Significant Differences.** Under contract to the Army Signal Corps, General Electric has been developing microcircuitry by machine for producing electronic components (Aviation Week News 17, 1972, p. 30). Prototype machines are still in development, says Air Force has a small number of machines at Stanford Research Institute. Significant difference between these programs and the Navy's is that the former are designed to use conventional resistors, capacitors, and other components rather than machine-made during the manufacturing process.

That will be an important difference to component manufacturers if the Project Tinkertoy process spreads, though for the industry. Component suppliers who attended the Navy demonstration reportedly could compare over their position. It seems certain some component manufacturers will consider the possibility of producing Tinkertoy modules themselves and applying these to component manufacturers.

• **Industry Enthusiasm.** The Navy plans to make available all its Project Tinkertoy know-how and data to qualified industries, and several already have made inquiries. A Navy spokesman told Aviation Week: The Navy also is studying an additional demonstration in industry research and plans to show a Project Tinkertoy display and review of the manufacturing process at the National Electronics Conference in Chicago, Sept. 28-30.—JK

Demand for Jet Fuel Nears Avgas Market

Demand for jet aircraft fuel will approach the market for aviation gasoline by the end of 1974, James H. Doellittle, vice president of the Shell Oil Co., told the 51st annual meeting of the National Petroleum Assn. in Atlantic City.

Doellittle said the national demand for aviation gasoline would continue to increase slightly during the next several years but will be overtaken by the steadily more requirement for jet fuel before the end of next year. The market for commercial aviation gasoline will continue to expand gradually until turbojets and turbofans now use aviation kerosene.

• **Jet Fuel Needs.** He emphasized that any national emergency similar to the Korean war or the immediate future would result in an increased aviation gasoline requirement, even such of the military forces involved, particularly low-altitude fighters would be able to operate on jet fuel.

Jet engines already are operating

the critical point for operations to be a more reliable operation of jet engines. Doellittle said "If facts are taken into account, the future trend of jet engines will not increase demands for synthetic lubricants that can meet the requirements of high-temperature jet engines."

These demands are based on today's generally increased fuel

Security Scuttles Jet Pod Debate

Avro's answer to Boeing arguments on engine mounts is withheld from Anglo-American air conference.

By David A. Anderson

London.—The British contingent to the joint Anglo-American Aeronautical Conference came loaded for bear in its rebuttal to U.S. arguments for pod-mounted jet engine installations. But a security officer got hot, fast, and the London fuel tank or side of the tank.

George Scherer, chief of Boeing Aerospace Co., a technical staff, once again presented the podded engine in a paper delivered during the first afternoon of the conference.

• **Defence on Security.** Strongest reaction to Scherer was reported from S. D. Drives, chief designer for A. V. Roe and Co., scheduled to present a paper on developing aircraft—underlined by most delegates to include a defense of the British approach of bonded engines. But at the last minute, the paper was withdrawn for security reasons.

Commander Sir William Ferris, president of the Royal Aeronautical Society "Owing to the difficulties about security it was decided that it is a mistake that you should know that such a thing (Avro's deluging engine) exists. How often it is pointed out what happened at Farnborough last week I do not know, but that it is one of the things those who risk our lives would explain it with us. We know who does not."

• **McDonnell's Feet.** Scherer's presentation generally was similar to those he has delivered in the U.S. (Aviation Week News 15, p. 29). But the paper contained one departure. During the discussion of his points on advantages of podded engines, an unmistakable picture of the Comet engine installation was audaciously shown on the screen.

"Now did that put us in a bind?" Scherer said. "But then, the point had been made. Out of the heated sides were sticking a pair of mechanical feet."

• **Threat Waiver.** George Edwards, director and chief engineer for Vulcan Aircraft, told all attendees to Scherer by stating that the British approach would have bomber requirements.

Design studies showed a low wing loading would be necessary, which

the British said "If facts are taken into account, the future trend of jet engines will not increase demands for synthetic lubricants that can meet the requirements of high-temperature jet engines."

These demands are based on today's generally increased fuel

Security Scuttles Jet Pod Debate

Avro's answer to Boeing arguments on engine mounts is withheld from Anglo-American air conference.

By David A. Anderson

London.—The British contingent to the joint Anglo-American Aeronautical Conference came loaded for bear in its rebuttal to U.S. arguments for pod-mounted jet engine installations. But a security officer got hot, fast, and the London fuel tank or side of the tank.

George Scherer, chief of Boeing Aerospace Co., a technical staff, once again presented the podded engine in a paper delivered during the first afternoon of the conference.

• **Defence on Security.** Strongest reaction to Scherer was reported from S. D. Drives, chief designer for A. V. Roe and Co., scheduled to present a paper on developing aircraft—underlined by most delegates to include a defense of the British approach of bonded engines. But at the last minute, the paper was withdrawn for security reasons.

Commander Sir William Ferris, president of the Royal Aeronautical Society "Owing to the difficulties about security it was decided that it is a mistake that you should know that such a thing (Avro's deluging engine) exists. How often it is pointed out what happened at Farnborough last week I do not know, but that it is one of the things those who risk our lives would explain it with us. We know who does not."

• **McDonnell's Feet.** Scherer's presentation generally was similar to those he has delivered in the U.S. (Aviation Week News 15, p. 29). But the paper contained one departure. During the discussion of his points on advantages of podded engines, an unmistakable picture of the Comet engine installation was audaciously shown on the screen.

"Now did that put us in a bind?" Scherer said. "But then, the point had been made. Out of the heated sides were sticking a pair of mechanical feet."

• **Threat Waiver.** George Edwards, director and chief engineer for Vulcan Aircraft, told all attendees to Scherer by stating that the British approach would have bomber requirements.

Design studies showed a low wing loading would be necessary, which

the British said "If facts are taken into account, the future trend of jet engines will not increase demands for synthetic lubricants that can meet the requirements of high-temperature jet engines."

These demands are based on today's generally increased fuel

Security Scuttles Jet Pod Debate

Avro's answer to Boeing arguments on engine mounts is withheld from Anglo-American air conference.

By David A. Anderson

London.—The British contingent to the joint Anglo-American Aeronautical Conference came loaded for bear in its rebuttal to U.S. arguments for pod-mounted jet engine installations. But a security officer got hot, fast, and the London fuel tank or side of the tank.

George Scherer, chief of Boeing Aerospace Co., a technical staff, once again presented the podded engine in a paper delivered during the first afternoon of the conference.

• **Defence on Security.** Strongest reaction to Scherer was reported from S. D. Drives, chief designer for A. V. Roe and Co., scheduled to present a paper on developing aircraft—underlined by most delegates to include a defense of the British approach of bonded engines. But at the last minute, the paper was withdrawn for security reasons.

Commander Sir William Ferris, president of the Royal Aeronautical Society "Owing to the difficulties about security it was decided that it is a mistake that you should know that such a thing (Avro's deluging engine) exists. How often it is pointed out what happened at Farnborough last week I do not know, but that it is one of the things those who risk our lives would explain it with us. We know who does not."

• **McDonnell's Feet.** Scherer's presentation generally was similar to those he has delivered in the U.S. (Aviation Week News 15, p. 29). But the paper contained one departure. During the discussion of his points on advantages of podded engines, an unmistakable picture of the Comet engine installation was audaciously shown on the screen.

"Now did that put us in a bind?" Scherer said. "But then, the point had been made. Out of the heated sides were sticking a pair of mechanical feet."

• **Threat Waiver.** George Edwards, director and chief engineer for Vulcan Aircraft, told all attendees to Scherer by stating that the British approach would have bomber requirements.

Design studies showed a low wing loading would be necessary, which



CHANNELWING BRIGADIER FLIES

Brigadier Brigadier equipped with Custer channel wing makes its debut in during its recently completed flight test program.

Designed the CCB-8, the light transport now has been tested in the English Channel in June and Oct. 16.



F-36H FLIES AT COLUMBUS

First North America F-36H Solo to come off the company's Columbus, Ohio, production line is shown taking off in a test flight. The new F-36H and people fighter.

bracket a slightly larger than previous fighter fighters and is powered by the new General Electric J71, which develops more thrust than the J71 in afterburner.

Post Office Starts Airmail Experiment

They at facilities U. S. and have the mail and take to the air line this week or early next, starting a revolutionary experiment by Post Office and the airlines.

Airmail service for Letter-Shipments and news journals may be expanded within a year to cover major routes, Postmaster General Arthur Summerfield says. Initial routes are New York-Chicago and Washington-Chicago.

The airmail certificate to haul as mail on these routes are American, Capital, TWA and United. All agreed to the rates, but some did so grudgingly. Rates are 15-35 cents a two-mile, compared with 45-75 cents for straight (overland).

Civil Aeronautics Board had work gone full approval to these low rates proposed in September last but two weeks previous by Summerfield (Airmail Service Sept. 21, p. 19).

Other Civilian-Summerfield said he was "vehemently gratified" by the Board's record-speed action because it is the commercial rates. But he added a strong statement, emphatically urging CAB to let down the bars to cargo mail possibly needed action for participation in the mail airmail.

He said: "We understood that other carriers have applications to carry letters and other preferential mail by air, and we are seeking inclusion in their possible addition to the list of those already authorized to do so."

Flying Tiger Line and Sky America have petitioned CAB for permission to fly the mail at preferential rates. They claim that facilities mail service is an airfreight class of service and that airfreight certificates therefore include transportation of this type of mail.

Skid American-American Airlines had of back strong that the Time-Slick routes to CAB was somewhat kind and, furthermore, that "in any event, so much competition that there is any mail should be provided... without consideration of their respective contributions passed after notice and hearing."

American adds: "Even if Skid and Flying Tiger had shown more public spirit for the service they propose, there would be no prohibition for direct service the certificate provisions of the Civil Aeronautics Act as they seek to do."

To show that there is no compelling need for additional carriers, American cites statistics. The company says: "Average daily mail volume in the cargo compartments of the airmail operated by American and United, based on company figures, New York-Chicago amounts to over 100 tons a day."

This is "more than three times the volume of New York-Chicago first-class and other preferential mail entered in the Postmaster General's petition." And this does not include other AA and UAL, New York-Chicago flights that make one or more stops en route, American says.

BOAC's Comet Makes Record Flight

(McGraw-Hill World News)

London—First production Comet 2 to roll out of de Havilland Aircraft Co.'s plant made a record run last week to and from Rome in 10 hours during a route test of British Overseas Airways Corp.'s new jet transport service to South America.

De Havilland plans to produce approximately 45 of the new Comet versions, last announced order for 11.

As the first Comet 2 made its record flight, schedules for night additional Mail 2s were on the DH production line at Hatfield Aerodrome. Two more

were under construction at the company's Glasgow plant, and two are being built by Short Bros. & Hanford at Belfast, Northern Ireland.

To pave the way for Comet 3s, de Havilland plans to wind up deliveries of Mark 2s earlier in 1955. But production can be stepped up beyond 45 planes to meet additional orders.

Meanwhile, taking out of the DH experimental shop at Hatfield is the new version of the prototype Comet 1. Company officials say the airliner will make its maiden flight next June.

Hiller Gets License For Doman Copter

Dennis Hillcopter, Danbury, Conn., has licensed production of its H-31 to Hiller Helicopters, Palo Alto, Calif., plant to meet increased military demand for the three-place, Lycoming-powered Army ambulance.

Company spokesmen report the agreement will enable for the H-31's military kit, provide a "flexible ready-to-use" license on sales by Hiller.

Civil Aircraft, Engine Shipments			
	July 1953	June 1953	July 1953
Complete aircraft	482	339	151
By weight of aircraft:			
Less than 3,000 lb.	178	146	128
3,000 lb. and heavier	24	23	25
By number of places:			
One to three places	378	316	328
More than five places	24	21	25
By total net wt. of engines:			
Up to 100 hp.	178	146	128
400 hp. and over	24	23	25
Total value of shipments of complete aircraft and parts (1953 estimated)	\$11,485	\$23,710	\$22,645
Aircraft parts	23,117	28,385	15,511
Less than 3,000 exclusive lb.	3,516	2,800	2,739
3,000 lb. and heavier	19,601	25,585	12,772
Aircraft parts	5,529	7,784	3,779
Total value of shipments of aircraft engines and parts (1953 estimated)	\$82,749	\$113,903	\$118,551
Aircraft engines	5,191	6,636	2,957
Engine parts	1,668	6,636	5,641
Unfilled orders (1,200 lb. and heavier)	310	377	278

Civil Aircraft Shipments Increase

Aircraft industry shipped 482 civil planes valued at \$23.1 million during June, compared to 339 units at \$23 million in June, a most report of the Civil Aeronautics and Transport Administration reveals.

Engines shipped for civil aircraft amounted to 579 totaling \$82,749, a 5% increase in number and slight loss in percentage relative to shipments of the preceding month. Engine manufacturers shipped 529 powerplants

totaling \$68,600 in June. Airframe weight of the 1,665 aircraft shipped during the first seven months of 1953 totaled \$997,083. They were valued at \$125.1 million.

At the end of the same period last year, the total value was \$11.4 million. Backlog of aircraft orders for civilian planes of 3,000 lb. airframe weight and heavier amounted to 313 at the end of July, a decrease of 24 planes from the total at the end of June.

RADIOGRAPHY prevents waste



Radiograph of an iron casting for a reciprocating pump.

when a \$2 casting gets a \$375 treatment

This is a casting for a reciprocating pump. It is to be machined and hand scraped to a final finish of less than .0001 inch. Should perfectly show during machining, the cost of work done and lost treatment is wasted. The part must be scrapped, reworked.

The radiography reveals that by x-raying every casting, flaws are discovered before work is started. . . before hundreds of dollars have been invested in machining and heat-treating costs.

This is another example of the savings possible through radiography.

If you'd like to be sure all your castings are sound—if you'd like to know ways to improve yield in production runs—get in touch with your x-ray dealer. He'll gladly talk it over. Or, if you like, write us for a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N. Y.

Radiography . . .
another important function of photography

Kodak
SAFETY FILM

Grounded...

because
of
Instruments?



... call on Decker!

And your aircraft will be airborne sooner... for Decker Aviation Corporation can handle all your aircraft instrument repair, overhaul, or modification needs!

From a single gauge to entire flight packs—from gas gauges to gyro directional indicators—you can depend on Decker's laboratory to utilize and skilled technicians for outstanding service.

Decker was among the first to be CAA licensed for all four instrument classifications. It has maintained this leadership ever since through precision workmanship and prompt deliveries.

USAF, USAF, USAF Quality General Approval • CAA License, Class 1-3-2-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100-101-102-103-104-105-106-107-108-109-110-111-112-113-114-115-116-117-118-119-120-121-122-123-124-125-126-127-128-129-130-131-132-133-134-135-136-137-138-139-140-141-142-143-144-145-146-147-148-149-150-151-152-153-154-155-156-157-158-159-160-161-162-163-164-165-166-167-168-169-170-171-172-173-174-175-176-177-178-179-180-181-182-183-184-185-186-187-188-189-190-191-192-193-194-195-196-197-198-199-200-201-202-203-204-205-206-207-208-209-210-211-212-213-214-215-216-217-218-219-220-221-222-223-224-225-226-227-228-229-230-231-232-233-234-235-236-237-238-239-240-241-242-243-244-245-246-247-248-249-250-251-252-253-254-255-256-257-258-259-260-261-262-263-264-265-266-267-268-269-270-271-272-273-274-275-276-277-278-279-280-281-282-283-284-285-286-287-288-289-290-291-292-293-294-295-296-297-298-299-300-301-302-303-304-305-306-307-308-309-310-311-312-313-314-315-316-317-318-319-320-321-322-323-324-325-326-327-328-329-330-331-332-333-334-335-336-337-338-339-340-341-342-343-344-345-346-347-348-349-350-351-352-353-354-355-356-357-358-359-360-361-362-363-364-365-366-367-368-369-370-371-372-373-374-375-376-377-378-379-380-381-382-383-384-385-386-387-388-389-390-391-392-393-394-395-396-397-398-399-400-401-402-403-404-405-406-407-408-409-410-411-412-413-414-415-416-417-418-419-420-421-422-423-424-425-426-427-428-429-430-431-432-433-434-435-436-437-438-439-440-441-442-443-444-445-446-447-448-449-450-451-452-453-454-455-456-457-458-459-460-461-462-463-464-465-466-467-468-469-470-471-472-473-474-475-476-477-478-479-480-481-482-483-484-485-486-487-488-489-490-491-492-493-494-495-496-497-498-499-500-501-502-503-504-505-506-507-508-509-510-511-512-513-514-515-516-517-518-519-520-521-522-523-524-525-526-527-528-529-530-531-532-533-534-535-536-537-538-539-540-541-542-543-544-545-546-547-548-549-550-551-552-553-554-555-556-557-558-559-560-561-562-563-564-565-566-567-568-569-570-571-572-573-574-575-576-577-578-579-580-581-582-583-584-585-586-587-588-589-590-591-592-593-594-595-596-597-598-599-600-601-602-603-604-605-606-607-608-609-610-611-612-613-614-615-616-617-618-619-620-621-622-623-624-625-626-627-628-629-630-631-632-633-634-635-636-637-638-639-640-641-642-643-644-645-646-647-648-649-650-651-652-653-654-655-656-657-658-659-660-661-662-663-664-665-666-667-668-669-670-671-672-673-674-675-676-677-678-679-680-681-682-683-684-685-686-687-688-689-690-691-692-693-694-695-696-697-698-699-700-701-702-703-704-705-706-707-708-709-710-711-712-713-714-715-716-717-718-719-720-721-722-723-724-725-726-727-728-729-730-731-732-733-734-735-736-737-738-739-740-741-742-743-744-745-746-747-748-749-750-751-752-753-754-755-756-757-758-759-760-761-762-763-764-765-766-767-768-769-770-771-772-773-774-775-776-777-778-779-780-781-782-783-784-785-786-787-788-789-790-791-792-793-794-795-796-797-798-799-800-801-802-803-804-805-806-807-808-809-810-811-812-813-814-815-816-817-818-819-820-821-822-823-824-825-826-827-828-829-830-831-832-833-834-835-836-837-838-839-840-841-842-843-844-845-846-847-848-849-850-851-852-853-854-855-856-857-858-859-860-861-862-863-864-865-866-867-868-869-870-871-872-873-874-875-876-877-878-879-880-881-882-883-884-885-886-887-888-889-890-891-892-893-894-895-896-897-898-899-900-901-902-903-904-905-906-907-908-909-910-911-912-913-914-915-916-917-918-919-920-921-922-923-924-925-926-927-928-929-930-931-932-933-934-935-936-937-938-939-940-941-942-943-944-945-946-947-948-949-950-951-952-953-954-955-956-957-958-959-960-961-962-963-964-965-966-967-968-969-970-971-972-973-974-975-976-977-978-979-980-981-982-983-984-985-986-987-988-989-990-991-992-993-994-995-996-997-998-999-1000-1001-1002-1003-1004-1005-1006-1007-1008-1009-1010-1011-1012-1013-1014-1015-1016-1017-1018-1019-1020-1021-1022-1023-1024-1025-1026-1027-1028-1029-1030-1031-1032-1033-1034-1035-1036-1037-1038-1039-1040-1041-1042-1043-1044-1045-1046-1047-1048-1049-1050-1051-1052-1053-1054-1055-1056-1057-1058-1059-1060-1061-1062-1063-1064-1065-1066-1067-1068-1069-1070-1071-1072-1073-1074-1075-1076-1077-1078-1079-1080-1081-1082-1083-1084-1085-1086-1087-1088-1089-1090-1091-1092-1093-1094-1095-1096-1097-1098-1099-1100-1101-1102-1103-1104-1105-1106-1107-1108-1109-1110-1111-1112-1113-1114-1115-1116-1117-1118-1119-1120-1121-1122-1123-1124-1125-1126-1127-1128-1129-1130-1131-1132-1133-1134-1135-1136-1137-1138-1139-1140-1141-1142-1143-1144-1145-1146-1147-1148-1149-1150-1151-1152-1153-1154-1155-1156-1157-1158-1159-1160-1161-1162-1163-1164-1165-1166-1167-1168-1169-1170-1171-1172-1173-1174-1175-1176-1177-1178-1179-1180-1181-1182-1183-1184-1185-1186-1187-1188-1189-1190-1191-1192-1193-1194-1195-1196-1197-1198-1199-1200-1201-1202-1203-1204-1205-1206-1207-1208-1209-1210-1211-1212-1213-1214-1215-1216-1217-1218-1219-1220-1221-1222-1223-1224-1225-1226-1227-1228-1229-1230-1231-1232-1233-1234-1235-1236-1237-1238-1239-1240-1241-1242-1243-1244-1245-1246-1247-1248-1249-1250-1251-1252-1253-1254-1255-1256-1257-1258-1259-1260-1261-1262-1263-1264-1265-1266-1267-1268-1269-1270-1271-1272-1273-1274-1275-1276-1277-1278-1279-1280-1281-1282-1283-1284-1285-1286-1287-1288-1289-1290-1291-1292-1293-1294-1295-1296-1297-1298-1299-1300-1301-1302-1303-1304-1305-1306-1307-1308-1309-1310-1311-1312-1313-1314-1315-1316-1317-1318-1319-1320-1321-1322-1323-1324-1325-1326-1327-1328-1329-1330-1331-1332-1333-1334-1335-1336-1337-1338-1339-1340-1341-1342-1343-1344-1345-1346-1347-1348-1349-1350-1351-1352-1353-1354-1355-1356-1357-1358-1359-1360-1361-1362-1363-1364-1365-1366-1367-1368-1369-1370-1371-1372-1373-1374-1375-1376-1377-1378-1379-1380-1381-1382-1383-1384-1385-1386-1387-1388-1389-1390-1391-1392-1393-1394-1395-1396-1397-1398-1399-1400-1401-1402-1403-1404-1405-1406-1407-1408-1409-1410-1411-1412-1413-1414-1415-1416-1417-1418-1419-1420-1421-1422-1423-1424-1425-1426-1427-1428-1429-1430-1431-1432-1433-1434-1435-1436-1437-1438-1439-1440-1441-1442-1443-1444-1445-1446-1447-1448-1449-1450-1451-1452-1453-1454-1455-1456-1457-1458-1459-1460-1461-1462-1463-1464-1465-1466-1467-1468-1469-1470-1471-1472-1473-1474-1475-1476-1477-1478-1479-1480-1481-1482-1483-1484-1485-1486-1487-1488-1489-1490-1491-1492-1493-1494-1495-1496-1497-1498-1499-1500-1501-1502-1503-1504-1505-1506-1507-1508-1509-1510-1511-1512-1513-1514-1515-1516-1517-1518-1519-1520-1521-1522-1523-1524-1525-1526-1527-1528-1529-1530-1531-1532-1533-1534-1535-1536-1537-1538-1539-1540-1541-1542-1543-1544-1545-1546-1547-1548-1549-1550-1551-1552-1553-1554-1555-1556-1557-1558-1559-1560-1561-1562-1563-1564-1565-1566-1567-1568-1569-1570-1571-1572-1573-1574-1575-1576-1577-1578-1579-1580-1581-1582-1583-1584-1585-1586-1587-1588-1589-1590-1591-1592-1593-1594-1595-1596-1597-1598-1599-1600-1601-1602-1603-1604-1605-1606-1607-1608-1609-1610-1611-1612-1613-1614-1615-1616-1617-1618-1619-1620-1621-1622-1623-1624-1625-1626-1627-1628-1629-1630-1631-1632-1633-1634-1635-1636-1637-1638-1639-1640-1641-1642-1643-1644-1645-1646-1647-1648-1649-1650-1651-1652-1653-1654-1655-1656-1657-1658-1659-1660-1661-1662-1663-1664-1665-1666-1667-1668-1669-1670-1671-1672-1673-1674-1675-1676-1677-1678-1679-1680-1681-1682-1683-1684-1685-1686-1687-1688-1689-1690-1691-1692-1693-1694-1695-1696-1697-1698-1699-1700-1701-1702-1703-1704-1705-1706-1707-1708-1709-1710-1711-1712-1713-1714-1715-1716-1717-1718-1719-1720-1721-1722-1723-1724-1725-1726-1727-1728-1729-1730-1731-1732-1733-1734-1735-1736-1737-1738-1739-1740-1741-1742-1743-1744-1745-1746-1747-1748-1749-1750-1751-1752-1753-1754-1755-1756-1757-1758-1759-1760-1761-1762-1763-1764-1765-1766-1767-1768-1769-1770-1771-1772-1773-1774-1775-1776-1777-1778-1779-1780-1781-1782-1783-1784-1785-1786-1787-1788-1789-1790-1791-1792-1793-1794-1795-1796-1797-1798-1799-1800-1801-1802-1803-1804-1805-1806-1807-1808-1809-1810-1811-1812-1813-1814-1815-1816-1817-1818-1819-1820-1821-1822-1823-1824-1825-1826-1827-1828-1829-1830-1831-1832-1833-1834-1835-1836-1837-1838-1839-1840-1841-1842-1843-1844-1845-1846-1847-1848-1849-1850-1851-1852-1853-1854-1855-1856-1857-1858-1859-1860-1861-1862-1863-1864-1865-1866-1867-1868-1869-1870-1871-1872-1873-1874-1875-1876-1877-1878-1879-1880-1881-1882-1883-1884-1885-1886-1887-1888-1889-1890-1891-1892-1893-1894-1895-1896-1897-1898-1899-1900-1901-1902-1903-1904-1905-1906-1907-1908-1909-1910-1911-1912-1913-1914-1915-1916-1917-1918-1919-1920-1921-1922-1923-1924-1925-1926-1927-1928-1929-1930-1931-1932-1933-1934-1935-1936-1937-1938-1939-1940-1941-1942-1943-1944-1945-1946-1947-1948-1949-1950-1951-1952-1953-1954-1955-1956-1957-1958-1959-1960-1961-1962-1963-1964-1965-1966-1967-1968-1969-1970-1971-1972-1973-1974-1975-1976-1977-1978-1979-1980-1981-1982-1983-1984-1985-1986-1987-1988-1989-1990-1991-1992-1993-1994-1995-1996-1997-1998-1999-2000-2001-2002-2003-2004-2005-2006-2007-2008-2009-2010-2011-2012-2013-2014-2015-2016-2017-2018-2019-2020-2021-2022-2023-2024-2025-2026-2027-2028-2029-2030-2031-2032-2033-2034-2035-2036-2037-2038-2039-2040-2041-2042-2043-2044-2045-2046-2047-2048-2049-2050-2051-2052-2053-2054-2055-2056-2057-2058-2059-2060-2061-2062-2063-2064-2065-2066-2067-2068-2069-2070-2071-2072-2073-2074-2075-2076-2077-2078-2079-2080-2081-2082-2083-2084-2085-2086-2087-2088-2089-2090-2091-2092-2093-2094-2095-2096-2097-2098-2099-2100-2101-2102-2103-2104-2105-2106-2107-2108-2109-2110-2111-2112-2113-2114-2115-2116-2117-2118-2119-2120-2121-2122-2123-2124-2125-2126-2127-2128-2129-2130-2131-2132-2133-2134-2135-2136-2137-2138-2139-2140-2141-2142-2143-2144-2145-2146-2147-2148-2149-2150-2151-2152-2153-2154-2155-2156-2157-2158-2159-2160-2161-2162-2163-2164-2165-2166-2167-2168-2169-2170-2171-2172-2173-2174-2175-2176-2177-2178-2179-2180-2181-2182-2183-2184-2185-2186-2187-2188-2189-2190-2191-2192-2193-2194-2195-2196-2197-2198-2199-2200-2201-2202-2203-2204-2205-2206-2207-2208-2209-2210-2211-2212-2213-2214-2215-2216-2217-2218-2219-2220-2221-2222-2223-2224-2225-2226-2227-2228-2229-2230-2231-2232-2233-2234-2235-2236-2237-2238-2239-2240-2241-2242-2243-2244-2245-2246-2247-2248-2249-2250-2251-2252-2253-2254-2255-2256-2257-2258-2259-2260-2261-2262-2263-2264-2265-2266-2267-2268-2269-2270-2271-2272-2273-2274-2275-2276-2277-2278-2279-2280-2281-2282-2283-2284-2285-2286-2287-2288-2289-2290-2291-2292-2293-2294-2295-2296-2297-2298-2299-2300-2301-2302-2303-2304-2305-2306-2307-2308-2309-2310-2311-2312-2313-2314-2315-2316-2317-2318-2319-2320-2321-2322-2323-2324-2325-2326-2327-2328-2329-2330-2331-2332-2333-2334-2335-2336-2337-2338-2339-2340-2341-2342-2343-2344-2345-2346-2347-2348-2349-2350-2351-2352-2353-2354-2355-2356-2357-2358-2359-2360-2361-2362-2363-2364-2365-2366-2367-2368-2369-2370-2371-2372-2373-2374-2375-2376-2377-2378-2379-2380-2381-2382-2383-2384-2385-2386-2387-2388-2389-2390-2391-2392-2393-2394-2395-2396-2397-2398-2399-2400-2401-2402-2403-2404-2405-2406-2407-2408-2409-2410-2411-2412-2413-2414-2415-2416-2417-2418-2419-2420-2421-2422-2423-2424-2425-2426-2427-2428-2429-2430-2431-2432-2433-2434-2435-2436-2437-2438-2439-2440-2441-2442-2443-2444-2445-2446-2447-2448-2449-2450-2451-2452-2453-2454-2455-2456-2457-2458-2459-2460-2461-2462-2463-2464-2465-2466-2467-2468-2469-2470-2471-2472-2473-2474-2475-2476-2477-2478-2479-2480-2481-2482-2483-2484-2485-2486-2487-2488-2489-2490-2491-2492-2493-2494-2495-2496-2497-2498-2499-2500-2501-2502-2503-2504-2505-2506-2507-2508-2509-2510-2511-2512-2513-2514-2515-2516-2517-2518-2519-2520-2521-2522-2523-2524-2525-2526-2527-2528-2529-2530-2531-2532-2533-2534-2535-2536-2537-2538-2539-2540-2541-2542-2543-2544-2545-2546-2547-2548-2549-2550-2551-2552-2553-2554-2555-2556-2557-2558-2559-2560-2561-2562-2563-2564-2565-2566-2567-2568-2569-2570-2571-2572-2573-2574-2575-2576-2577-2578-2579-2580-2581-2582-2583-2584-2585-2586-2587-2588-2589-2590-2591-2592-2593-2594-2595-2596-2597-2598-2599-2600-2601-2602-2603-2604-2605-2606-2607-2608-2609-2610-2611-2612-2613-2614-2



NEWMATICS

SELF-CONTAINED RHODES LEWIS HIGH-PRESSURE (3000 psi) COMPRESSOR SAVES SPACE, WEIGHT, MAINTENANCE



features: Integral package unit, requires only simple power source and reservoir connections... operates 280 hours continuous duty per Specification MIL-C-1125... used extensively in military aircraft pneumatic systems... easy to install and service... takes less than five minutes to install or remove entire package unit. Approved by U. S. Navy for installation in military aircraft.

See Rhodes Lewis for these new lightweight products and systems

ITEM	Used in light aircraft (military and civilian)	Used in transport aircraft	Used in engine test cells
42 & 42C Compressors	X	X	
Operationally Simple Compressor	X	X	
Weight Sensitive Compressor	X	X	
Engine Pneumatic Systems	X	X	
Electrical & Electronic Control Systems			X
42 & 42C Motors	X	X	X
Small Reciprocating Turbine Engines	X	X	X
Pneumatic Valves, Operated Electronically or Mechanically	X	X	X
Automatic Inflation in Gasoline Tanks	X	X	X
Reservoir (Liquid) Options	X	X	

Take advantage of Rhodes Lewis engineering knowledge and manufacturing facilities in the field of electrical and pneumatic equipment. Your inquiries are cordially invited.



RHODES LEWIS CO.

Scholarship of McCulloch Motors Corporation

4151 W. 99th Street,
Los Angeles 48, California



ELECTRIC
PNEUMATIC

ENGINEERS-MANUFACTURERS

from the residents, the people will follow them. Or if you move them so far away that they are completely remote from the city, how can they be accessible to people who travel by air?" he stated.

Douglas's cool words did little to quash the angry fan, however. At week's end the protest still was making headlines.

New Decrees Revise Air France Setup

(McGraw-Hill World News)

Paris—France's government has published two decrees altering a substantial reorganization of the French air transport industry.

Under the first decree, the national carrier, Air France, will be partly de-nationalized. A public offering of Air France stock will be made to provide funds for the continuation of the long-term development program. Amount of public participation in ownership and management of Air France has not been determined, but it is presumed the government will retain a majority interest.

New financial setup will make it possible for the government to limit its subsidies to payments for certain flights which, though commercially unprofitable, are considered to be in the national interest. The public stock offering is made possible by the fact Air France is operating at a profit 1972 net amounted to \$314,000.

Second Decree—The second decree gives the Ministry of Air Aviation broad powers to regulate air traffic in order to avoid what is termed "possible competition."

The ministry will have power to disallow air traffic between Air France and private French carriers by limiting the number of airlines authorized to fly particular routes and by splitting up traffic in some more important routes according to quotas.

Air France and Compagnie Generale de Transport Aeronautique, one of the big privately-owned airlines, have studied an agreement to share air traffic between France and Algeria. The agreement gives Air France 55% of the traffic and CGTA 45%. It is expected to be far more difficult to reach an agreement among carriers operating between France and Mexico.

S & W Officers Buy 3,300 Stock Shares

Recent stock transactions reported by the aviation industry to Securities & Exchange Commission last month were purchases of 3,300 common shares



"DME/VOR MOST USEFUL NAVIGATION AID AVAILABLE"

... says Cole H. Morrow of J.I. Case Co.

The J. I. Case Company, manufacturers of power farm machinery, have been flying experimental DME since December 1968 in one of the company's planes. Shown above are Elmo Halverson, Chief Pilot, Paul Johns, Pilot, and Cole H. Morrow, Chief Plant Engineer, looking at the DME antenna.

Mr. Morrow, who is also Chairman of The National Business Aircraft Association, says, "When all the present DME ground equipment is installed and operating, the air-borne VOR and DME will provide business aircraft

operators the most accurate and useful navigation aid that has ever been available."

Bendix Distance Measuring Equipment can also help you to reduce operating costs, navigate along new or unfamiliar routes with greater accuracy, hold at unmarked points and estimate arrival times more accurately.

For additional information write:

BENDIX® RADIO

BENTON & BOWEN
A DIVISION OF BENDIX
AERONAUTIC CORPORATION

Grand Central Station International Building
100 E. 42nd St. New York 17, N.Y. 10017
Bendix Radio Sales
19001-Aurora Blvd. St. Louis, Mo. 63114



Bendix

THE MOST TRUSTED NAME IN

Radio

Circle 61 on Reader Service

the Process that Helped to

SPEED UP JET ENGINE PRODUCTION



Complicated power blades and buckets for jet engines require the use of high-milling-speed alloys that are slow and costly to produce by ordinary methods of manufacturing. The Microcast Process of investment casting produces these parts for use as cast, reducing machining and grinding operations to an absolute minimum.

This process is particularly well suited to similar applications requiring the use of high-temperature alloys. Let us show you how MICROCAST parts can fit into your product's design.

**MICROCAST
DIVISION**

austenal laboratories, inc.
334 East 19th St., New York 10, New York
390 South Chicago Ave., Chicago 10, Ill.



of Seaboard & Western Airlines stock by three officers of the company. Arthur V. Norden bought 2,800 shares, boosting his total holding to 18,421 shares; Wallace F. Norris purchased 1,800 to make a total of 1,526; and Harold Munster bought 900, bringing his total to 2,700.

Other stock transactions:

Air America, Inc.—C. Kenneth Kasper, director, bought 100 common shares, making a total of 110. Stephen A. McFadden, director, bought 100 common shares, making a total of 100. J. H. McFadden, director, bought 100 common shares, making a total of 100. J. H. McFadden, director, bought 100 common shares, making a total of 100.

Air Transport Company, Inc.—K. A. Nelson, director, bought 100 common shares, making a total of 100.

Northwest Airlines, Inc.—William M. Allen, director, bought 100 common shares, making a total of 100.

United Airlines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Western Airlines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Continental Airlines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Eastern Airlines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Southwest Airlines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Allegiant Air, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

JetBlue Airways, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Delta Air Lines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

American Airlines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

United Express, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Allegiant Air, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

JetBlue Airways, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Delta Air Lines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

American Airlines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

United Express, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Allegiant Air, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

JetBlue Airways, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Delta Air Lines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

American Airlines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

United Express, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Allegiant Air, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

JetBlue Airways, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Delta Air Lines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

American Airlines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

United Express, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Allegiant Air, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

JetBlue Airways, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Delta Air Lines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

American Airlines, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

United Express, Inc.—Charles H. Smith, director, bought 100 common shares, making a total of 100.

Four Transmitters in One



wilcox 99 Multi-Frequency Transmitter

- 40 W. 100 R.F. channels in 125-525 k/c, 3-20 MHz (18-132 m/c frequency range)
- Output 400 watts LF and HF, 350 watts HF
- Extremely easy to inspect and maintain
- Single or simultaneous transmission for greater flexibility
- Complete remote control operation

Write today for complete specifications.

wilcox

Fourteenth and Clinton
Kansas City 17, Mo., U.S.A.

DH-Canada to Design New Light Transport

De Havilland Aircraft of Canada has been awarded a \$25,774 contract by the Canadian government for design and development of a new light transport plane.

The firm also has won a \$25,500 award to work out a wheel-to-axle arrangement for aircraft.

The awards were made known by the Canadian Department of Defense Production, Ottawa. The department revealed it had let contracts totaling \$774,000 for aircraft parts and equipment during the July 26-31 period.



MAGNESIUM FUSelage is shown taking shape at East Coast Aeronautics plant. ECA made experimental magnesium wing for F-105.

AMC to Test All-Magnesium F-80C

USAF evaluation will show if performance of experimental light-metal plane matches its production possibilities.

By Irving Stone

The future utilization of magnesium as a structural material in aircraft is under consideration at Wright Air Development Center. At least two types of planes—a new trainer and a new fighter—are being actively considered for all-magnesium covering. A definite policy on the exploitation of magnesium's potential in advances is expected to be formulated in the very near future.

This new interest in the material comes at a time when the Air Materiel Command is getting ready to evaluate the first all-magnesium, combat-type, "all-magnesium" aircraft as the first phase in a body experiment aimed at lower cost, simplified structure.

The plane which AMC will check is a Lockheed F-80C, with its aluminum alloy structure redesigned and fabricated from magnesium alloys by East Coast Aeronautics, Inc., Pichon, Missouri. N. Y., under experimental contract.

Wings, Then Fuselage—Components for the all-magnesium F-80C were constructed by ECA under two separate contracts, one for the wing (Aeronautics News, July 4, 1949, p. 25) and one for the fuselage.

This story carries first details on how ECA made the magnesium fuselage. Thick, Bent Lighter—A process in the field of magnesium structures, ECA says magnesium alloys is permitting the use of thick skins with no weight increase, allowing the elimination of stiffening members and doublers. This use of fewer parts cuts overhead for engineering, design and manufacture of tools, parts fabrication and assembly. Lower structure requirements add up to reduced cost of structure.

Speed of aircraft in the immediate future will not bar use of magnesium alloys. For an equilibrium test, requirements of 2500, a value claimed safe

for the material, are level speed would be close to 1,100 mph, and at 50,000 ft close to 1,500 mph.

In the wing project, East Coast reported a considerable amount of simplification achieved. In comparison with about 1,640 parts and 47,700 fastenings in the original aluminum alloy wing, the ECA built magnesium structure contains only about 938 pieces and 16,300 fastenings. Both static and flight articles passed testing.

Fuselage project was begun by ECA in mid-1948 and also covered a static test and a flight article. In addition to the body proper and empennage, that phase of the work also included



NOTCHFORMED parts include 1-ft. notch for flow tunnel (left) made on press tools and built-up section of 364-in. Dow F9 1414 suspension made on hydraulic press.



the construction of internal end flaps in magnesium. These two surfaces are not built included in the wing job.

Tests Show—The static test fuselage was delivered to AMC in June. It is scheduled for early testing and will be covered with an aluminum alloy wing which easily will be used for support purposes in the trial.

The flight article is slated for delivery early in 1954. This fuselage and tail combination with a pair of magnesium wing panels previously built by ECA and stored there will comprise the all-magnesium F-80C to be flight tested by AMC.

Interchangeability Required—Actually the F-80C is only a testing-proving vehicle for the benefits of magnesium as a structural material. Although it did afford an opportunity to develop a means of fabrication to meet new design and production problems and generally point up the advantages involved in using the material, the limitations imposed by the transition from an established design in aluminum alloy to one in magnesium necessarily involved some compromises.

Main limiting factor was the requirement of interchangeability of fuselage, wings, nacelles, flaps, tail and landing gear, with the prototype F-80C's corresponding parts in aluminum alloy.

Another established design recently adapted to magnesium by ECA is the Goanum FV-2 Fastjet wing (Aeronautics News Sept. 1, 1951, p. 11).

Design From Knowledge—The F-60 and FV-2 systems in magnesium do not take full advantage of the metal's properties, it is claimed.

The only way of establishing the degree of simplification and cost reduction attainable with magnesium is to design from scratch an airplane re-composing the overall use of the metal.



CAST PARTS used in experimental magnesium fuselage might be eliminated in large-scale production because of solid casting in sand. Spikes in built-up section (left) prevent warpage in castings they are not very thin.



MAGNESIUM NOSE CONSTRUCTION—No stiffeners in upper forward section, immediate fuselage streamlines design closely, because of gas circulation problems.



MIDSECTION, with forward end at right, ends in fuselage. Note absence of stiffeners in the magnesium version. Arrow point to cast magnesium members.



F-48 AVT FUSELAGE in magnesium (left) and aluminum (right). Magnesium is lighter, can be used in greater thickness, eliminating need for stiffeners.





MAGNESIUM stiffener has half its weight of an equivalent Lockheed design.



TAPER on horizontal stiffener also is obtained with same-cost magnesium.

tural aluminum alloy construction.

► **Fast Details**—Here are the details on how ECA constructed the fuselage, tail, ailerons and fins to complete the all-magnesium F-8C.

Because of interchangeability requirements, the magnesium nose section lay-out had to maintain the same gun location, same gun attach points, and attachment locations of nose section to the fuselage substructure. As a result of these restrictions, very little modification was accomplished in this section.

In general, internal parts were boosted to give the required strength in magnesium alloy. This usually gave a heavier part for an equivalent weight in aluminum alloy.

By means of the heavier (about 40%) plate skin used—resulting in a higher buckling allowable—the skin stiffness was dissipated in the upper nose section.

All fins and bulkheads, except nose sheet in the lower part of the section, were fabricated from Dow Chemical's F8 Hb24 magnesium sheet. All ingots were fabricated from Dow's ZK 60A-T5 extrusion.

► **Modulation, Cuttings**—In the fuselage modulation, the heavier gages used for skin, bulkheads and frames also permitted the elimination of all skin stiffeners, except in the aft lower section. However, the interchange-

ability requirement dictated the retention of the nose structural load-carrying longitudinal as in the standard aluminum alloy F-8C.

Sheet and extrusion material was stock as that used in the nose section. Other simplification involved the use of magnesium castings instead of built-up fuselage members. This was done to reduce the number of parts where possible, even though casting machining penalties were involved. In a previous version (as distinguished from the experimental version) it is possible that it might be feasible to use built-up members instead of the castings because of the machining methods and tooling involved.

Cast members included the second and third upper frame portions forward of the aft pressure bulkhead, because of the greater rigidity requirements in the pressurized area.

Other structural members adapted to castings were the air scoop bulkhead, the forward and aft wing attachment bulkheads (rock casing attachment at the vertical centerline at the bottom to about 135 deg. towards the top), and a portion of the flap actuator support frame.

► **Aft Section**—Magnesium construction in the aft section also permitted the elimination of the longitudinal stiffeners. Five longest were retained,

with four of these running the full length of the section and also serving as the skin splices. A fifth longest located at the bottom center was left for about half the section length. Longitudinal are ZK 60A-T5 extrusions, while skin is F8 Hb24 sheet, as in the other sections.

Nonmagnesium members in the aft section are the forward bulkheads and those supporting the tail section. These members are aluminum sheet.

► **Stabilizer Details**—The stabilizer represents an interesting conversion from aluminum to magnesium. The aluminum structure had two beams, eight chordwise ribs, and longitudinal stringers in each panel. The magnesium structure replaced these beams and ribs ribs per panel.

Beams material is ZK 60A-T5 extrusion, machined with straight taper towards the tip. Forward and rear beams are made up of two L-shaped members riveted together to form a channel with the apex and aft. The intermediate beam is made up of two T-sections with vertical webs riveted to form an I-beam section.

Ribs are sheet metal webs with air-trapped caps, except for the tip rib, which is all sheet metal.

► **Tapered Skin**—To obtain maximum beam bending efficiency and to avoid the expense, the hatched stabilizer was designed to use machine tapered magnesium skin extruding in one piece from root to tip on each panel. The skin are 52 in. long, measure 174 in. at the root and taper to 946 in. at the tip. Maximum width of skin is about 16 in.

The sheet was machined from hand rolled material conforming to Federal Specification QQ-H44, condition H. Tapering was done on an ECA modified wire roller arrangement, using a vacuum holding table fixture. The taper was obtained by tilting the vacuum bed at the slope of .0160 in./in.

► **Skirt Detail**—The lower skirt involved in the leading edge also posed a problem. This was solved by using a machined extrusion for a leading edge insert, with a recess in the aft portion to receive the bulk structure.

Initially it was thought that a casting could be used for the leading edge in cast to avoid extensive machining, but warpage difficulties encountered with the casting caused this attempt to be abandoned. For a production project, it is likely that the casting problem would be pushed to a satisfactory solution.

In the transition of the stabilizer from aluminum alloy to magnesium, the weight saving was picked up. The reason attributed for this possibly is that ECA was reported by AMEC to design the stabilizer for a much higher load—about 2.4 times standard.

► **Cuttings in Flap**—The magnesium



NOPCO LOCKFOAM

Versatile NEW Structural Tool

NOPCO's Lockfoam offers many new concepts in aircraft design, engineering, and manufacture.

As a strong, lightweight sanding material it has won unanimous acclaim in the aircraft industry.

In addition to its unique ability to be formed in place with compressed air and applied without the need for complicated equipment, Lockfoam promises to solve other outstanding problems that it has proved itself for countless applications.

Since Lockfoam can be formed in place to fill any cavity regardless of configuration, density of the material can be adjusted to meet design requirements. Tearing or separation under maximum characteristics are avoided. It can be used for the interior and thermal insulation.

It is capable of absorbing heavy impact loads with low shock transmission. Physical and chemical properties may be varied to suit probable and unexpected conditions as well as the use in seals, lubricants in bulk liquid and flexible foams.

The assurance of a structural reserve still in the selection, installation, and application of Lockfoam is readily seen from NOPCO's Lockfoam Users' Guide for complete technical data.



NOPCO

Chemical Company, Harrison, N. J.

Branches: Boston • Chicago • Cincinnati, Ga. • Richmond, Calif.

On the Lockheed A-1 Wildcat Intruder, Lockfoam is used to provide structural strength, lightweight construction, and improved performance. Lockfoam is used in both their commercial and military planes by Lockheed Aircraft Corporation.



Since Lockfoam does the work of sand and grout, it also serves as the elastic element of a cast-in-place skin-sanding board in skin areas.

Major Lockfoam is now used by the aircraft industry for a wide variety of applications to:

- INCREASE RIGIDITY OF CONTROL SURFACES by filling cavities in elevator, rudder, ailerons, wing ribs
- PROVIDE A STRESS COUPLER embedded between skinplates for new sections
- STRENGTHEN IMPER-ABSORBING STRUCTURES
- INSULATE cabin ventilating systems
- SEAL metal doors to prevent leaking
- REPAIR CRACK SPONGE PANELING
- DAMPEN VIBRATIONS
- FOR ELECTRONIC EQUIPMENT
- PARACUTE DOWNING

Major Lockfoam has many other potential uses listed on our Guide for details and technical service.



ANGLgear

... an important part
of this
TRIM TAB
CONTROL SYSTEM



A 1-way ANGLgear® right angle gear gear with supports in E-14 Rotax® Electric Rotary Actuator in this typical Actuator-actuated system ANGLgear—with the capacity of some many times its size—is ideal for such diverse aircraft applications as compact design, hardened gears, ball bearing meshing and mounting, float side mounting, and an internal pilot on the mounting ends as plus features.

Two basic sizes with three ratings are fully described in T A S Aeronautical Engineering Catalog See it for details.

DIBBORNE
ACCESSORIES CORPORATION
1414 Chelton Avenue, 70306-11 New Jersey

holder, for elevated well stream are basically the same in their aluminum alloy construction, except for the elimination of a rib line.

In this type, all ribs were eliminated and spider struts—less per foot—were installed between the hinge points and the trailing structure. The struts serve to take the load of the flap.

Hot Work-ECA has found that the working of magnesium alloys at elevated temperatures requires developing a set of new shop techniques and methods of heating both work and equipment. Hot working at elevated temperatures does provide these advantages:

- Parts can be formed in a single operation, without intermediate annealing and drawing—saving time and reducing distortion.
- Springback is almost eliminated at the higher temperatures of the working range.

ECA has found that when mag-

nesium alloys must be formed hot, it is desirable to preheat the sheet or extrusion to working temperature. In comparison to placing cold sheets in the die, preheating:

- Assures proper flowing temperatures.
 - Minimizes distortion resulting from internal strains.
 - Helps maintain dies at constant temperatures.
 - Assures production rate.
- When parts are extremely small, preheating is not necessary, ECA reports, since the part will absorb sufficient heat for forming from the die, without re-heating the temperature to any great extent.

A temperature limit of 350F was selected at ECA for all hot forming operations on FS-75 24 sheet. This temperature results in a maximum exposure time (during heating and loading) of about 15 min. based on compressive load strength, and about 18 min. based on tensile yield strength.



Plastics Aid in DC-6 Conversion

Reinforced plastics figure importantly in the recent conversion of 12 American Airlines DC-6s to high-density tour configurations by Lockheed Aircraft Service International at N. Y. International Airport, New York.

LeCroy Plastics Co., Inc., Farmingdale, N. Y., fabricated reinforced luggage racks and water tank compartments of laminated plastics. Use of these plastic parts is expected to have saved considerable weight and installation time.

Conversion of the metal racks, which formerly held blankets, pillows, bags and coats, overnight bags and lanterns to plastic sandwich installations for holding luggage was accomplished with an angle deck and divider web arrangement, which can take a 400 lb downward load on the deck or a forward load of 800 lb against the web. The



1

2

3

4

5

6

IT COSTS LESS This "repackaging" of Avien's fuel gauging system brings the purchase price to a new low. The system is reduced to a mounting unit and an indicating unit, eliminating the bulky and expensive intermediary unit.

IT'S 50% LIGHTER Lighter aluminum brings cost savings. Avien's Two-Unit Fuel Gauge is compact, the fuel gauge and amplifier function into the indicator case. Less wiring and connectors are needed.

IT NEEDS NO FIELD ADJUSTING With the elimination of the intermediate unit, which had to be supplied as a common part, all Avien units are pre-calibrated for the circuit they are designed for.

IT TAKES LESS TIME TO INSTALL The Two-Unit Gauge is remarkably easy to install. No specially-trained personnel are needed. No specialized test equipment is needed. No calibration instruction or data is needed.

IT'S EASIER TO MAINTAIN With fewer components in the system, less maintenance is required. Trouble-shooting becomes easier. And fewer parts must be stocked for replacement and repair.

IT CAN BE INTEGRATED WITH FUEL MANAGEMENT Simulators, level switches, fuel gauge outputs, etc., can be hooked up to the Two-Unit base system with less expense and less trouble than ever before.

6 definite ways you can cut costs with Avien's "TWO-UNIT" FUEL GAGE

Avien's Two-Unit Fuel Gauge is creating a lot of talk with manufacturers, engineers, and purchasing men.

The new "package" means that Avien units are now all "shelf items." As long as the units are designed for the same aircraft, they're completely interchangeable.

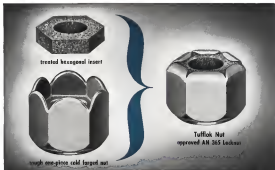
The Avien Two-Unit Fuel Gauge is now scheduled for production, to meet your manufacturing programs. The system is available in either large or small size, with all varieties of dial configurations.

Every month, Avien produces over two thousand major instrument components for the aviation industry.

We believe the Two-Unit Gauge is so important that your company should not be delayed another day. Write or call us.



AVIATION ENGINEERING DIVISION
AVIEN ENGINEERS, INC.
54-12 NORTHEAST BOULEVARD, WOODSIDE, L. I., N. Y.



You Get Tight Grip—Safety and Economy with Townsend Tufflok® Nuts

The tight grip and great safety you get with the Townsend Tufflok® Nut come from its special design and materials which combine to make it the toughest locknut ever produced.

Cold Forged Body of Tufflok Nut is in one piece. It has high mechanical strength and its exclusive spiral design ensures positive seating of the insert.

Tough three-arms are cut in cold-forged steel—are stronger—open in easier—break pulling—speed up ap-

lications—afford more re-use.

Treated Hex Insert is resilient, water-resistant like the fibrous high strength hexagonal structure. It resists corrosion, drying out, high-octane gasoline and lubricants.

Positive Locking Action is provided by hexagonal insert in which threads are impressed in resilient material—setting up constant pressure against the bolt threads, providing a friction grip, and holding the nut tight against vibration.

Tufflok Nuts are economical—have been proved by use and by test. They are approved against Air Force-Navy Aeronautical Specification AN-N-56 on self-locking nuts and are listed in Air Force-Navy Aeronautical bulletin ANA 159 as an approved AN 365 Post warner Nylon nuts.

To learn more about the tight grip and positive resistance to vibration and shock obtained with Townsend Tufflok Nuts, write for free literature.

*Trademark under The Nylon Corporation patents. Tufflok is a registered trademark of Townsend Company.



THE TOWNSEND ADVANTAGE—Representatives save 25% over—legislators: only sales price duty—Producers save half-normal types of cold steel—cold forged nuts—Quality first—Tufflok Nuts—self locking action—vibration—resistance—great safety—formed into parts.

Places: New England, Pennsylvania—Chicago, Illinois—Plymouth, Michigan—San Jose, California

In Canada: Patterson & Bellis Manufacturing Company, Ltd., Oshawa, Ontario.

installation is expected to have saved 145 lb.

The deck is made of 36 in sections of Kevlar cellular-reinforced plastic over sandwiched between Fiberglas foam. The triangular divider also has Kevlar core, sandwiched between plates of Kevlar. Goldenrod's 164 glass fabric with Velox finish, impregnated with poly ester resin. The divider is worked in and bonded to aluminum channel cap members. A two point retaining or clamp the divider to the cabin structure.

The deck is bolted to the under edge of the divider. An aluminum bracket mounts on the inboard edge of the deck and the lower portion of the inboard end of the divider.

The water tank compartment is integral part of cabin partition and is constructed of the same materials used in the deck, and is fast with a two-layer Fiberglas laminate. The compartment is constructed in a complete unit and is secured to the floor with two bolts, worked listening to with two bolts.

Aircraft Unions Join Forces in Wage Talks

United Auto Workers (UAW) and the International Association of Machinists (IAM) will combine forces in laboring contract negotiations with United Aircraft Corp., using a unified strategy that is scheduled for 1959-60 wage bargaining with other aerospace and engine manufacturers.

Union leaders on the labor side or executives have developed an "overall policy for early of approach in the aircraft field," a program that stems from the recent "solid economies" agreement between IAM and UAW.

The unions are scheduled to call for a general UAW to

- Beginning for "sleep improvement" of contracts at all United Aircraft plants
- Launching membership drive among the aircraft's employees

The IAM-UAW agreement covers negotiations at UAW's Pratt & Whitney Aircraft Division plants at East Hartford, Southington, Meriden, Portland and North Haven, Conn., Sikorsky Aircraft Division, Bridgeport, Conn., Chance Vought Aircraft Division, Tullahoma, Tenn., and Hamilton Standard Division, East Hartford.

Purpose of the agreement, labor leaders say, is to "strengthen our central bargaining position, to further our efforts to establish uniform contract provisions and to remove labor as a competitive factor in dealing with corporations that have multiple plants organized by two unions."



USED BY LEADING AIR LINES, THESE INDICATORS HAVE PROVEN THEIR RELIABILITY BY YEARS OF SATISFACTORY SERVICE.

THERMOCOUPLE TYPE

All LEWIS thermocouple indicators are fully cold-weld compensated, independently shielded and are available for use with iron-constantan, copper-constantan or chromel-nickel thermocouples in all standard ranges for the thermocouple material used. A few typical ranges are listed below.

MODEL 17A, 21A case to ANS 10442

—55 to +1500°C Cylinder Temp.

(AN 520-1A or 21A)

—50 to +1300°C Bearing Temp.

8 to +1200°C Exhaust Temp.

MODEL 47A, 17A case to ANS 10442

—50 to +1500°C Cylinder Temp.

8 to +1300°C Exhaust Temp.

MODEL 240 dual, 25A case to ANS 10442

—55 to +1500°C Cylinder Temp.

(AN 520-1A or 21A)

—50 to +1300°C Bearing Temp.

8 to +1200°C Exhaust Temp.

RESISTANCE TYPE

Accurate resistance-type LEWIS indicators are reasonably free of voltage error, have nearly linear scales (not curved at the ends) and are magnetically shielded. A few typical ranges are given below. Not shown is Model 46R, 25A range.

MODEL 47R, 17A case to ANS 10442

—75 to +150°C AN 5195-6 or AN 5197-6

8 to +1300°C Oil Temp.

—55 to +1300°C Air Temp.

MODEL 17R dual, 25A case to ANS 10442

—75 to +150°C AN 5195-6 or AN 5197-6

8 to +1300°C Oil Temp.

—55 to +1300°C Air Temp.

FOR BEST RESULTS USE LEWIS THERMOGRAPHY AND LEWIS GAUGES WITH THESE INDICATORS.

THE LEWIS ENGINEERING CO.

NAUATUCK, CONNECTICUT

Manufacturers of Complete Temperature Measuring Systems for Aircraft



it can give
even an
air giant
the "shakes"



MB produces the
largest vibration exciter
ever built

FROM HERE TO THERE—IT'S FASTER BY AIR!



You can get from where you are—to where you want to be—faster by air.
That's why—hundreds upon hundreds are joining the thousands upon thousands who yearly travel millions upon millions of miles—by air! Next time—save time—your time—fly!

power packages by

ROHR

You're boarding a United Airlines
Comet-Liner 340—and there as the wing
you see the Rohr-built "power packages"
readily to wing you along the skyways
of the world. For the Comet 340, and its
successor, the Comet 340, Rohr
manufactures and assembles the engine
cowl, cowling panels, ducts, exhaust system,
tanks and other units which transform
a Pratt & Whitney engine into a complete,
ready-to-install "power package."

WORLD'S LARGEST PRODUCER OF READY-TO-INSTALL



POWER PACKAGES FOR AIRPLANES

ROHR

AIRCRAFT CORPORATION

ORLANDO, FLORIDA
AND RIVERSIDE, CALIFORNIA

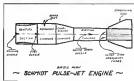
AERONAUTICAL ENGINEERING



ONE-LITTER AMBULANCE for helicopter use is tension cranked for Puro-Copter aircraft by inventor, George Schmidt.



"ALMOST SILENT" PULSEJET ENGINE used by Schmidt drives 125 lb. of thrust on speed breeze-test bed



Noise Is Cut in New Pulsejet Engine

A small pulsejet-powered helicopter, designed and built by George Schmidt in a combat evacuation craft, is nearing completion at the former Puro-Well engineer's Brookwood, N. Y., factory. Military interest has been shown in the Puro-Copter 2 (AVIATION WEEKS Sept. 7, p. 9), intended as a one-litter ambulance to fly wounded soldiers from front line areas to points of safety.

►"Silent" Operation—Schmidt's engine and constructed the 195-hp. three-cylinder pulsejet engine for his new craft, developed a special low-noise fuel inlet (P&E), and devised a silencing system that he claims will make the helicopter powerplant approximately 50% quieter than other existing types.

►"Almost silent" operation of the machine is projected as a big selling point for military operators and in the civilian market, if the engine develops a civil configuration of his design.

►Adjustable CG—Schmidt based the Model 2 on an earlier, similar step-type of helicopter that he built and flew successfully.

The Puro-Copter is constructed of welded steel tubing, stands 5 ft. 7 in. high, and has a folding tricycle landing gear of 2-in. base.

An aluminum seat, located directly under the rotor hub, is adjustable fore and aft for center of gravity balance. The single litter is carried directly under the pilot seat.

►Little Torque—Schmidt designed rotor controls that extracted from the rotor hub but now is installing conventional floor configuration demanded by the latest military specifications.

Practically no compensation for torque is required in the Puro-Copter's

control surfaces, the designer says, because the only torque coupling in the craft is caused by bearing friction. A small fan may be added to correct the friction effect, however, if the need is indicated by future flight tests.

►Powerful Pulsejet—Schmidt developed several innovations in design, operation and mounting of the helicopter pulsejet engines.

Each powerplant is 52 in. long, 8 in. in major diameter and weighs 17.5 lb. Although smaller than the new British pulsejet developed by Snecma-Bec for capture (story on next page), the Schmidt engine delivers more than twice the burner's 45 lb. thrust.

The engine shell is constructed of welded 307 stainless steel. ►Minimal Vibration—To preserve the life of the rotor in each pulsed, a washer of machined crutch doubled

is shifted and aimed with water is lifted from a high-pressure tank into a fuel line mounted just ahead of the throttle regulator. One part of the coolant is required for each hour of engine operation.

In operation, a small amount of coolant mixed with fuel is sprayed into the pulsejet just ahead of the venturi through a 500-in hole. The same fuel coolant mixture is injected into an expansion chamber at the engine through a No. 60 hole.

This combination, Schmidt claims, keeps valves much cooler, preserves their life and gives a better fuel mixture for operation.

► **Mild Package**—The Pan-Copter's 10-horsepower engine probably is the first to cut down noise of a pulsejet engine.

Schmidt closes the back, printing pop in two operations.

► **Noise** of 100 ft diameter spray water into the injection chamber, where the 1,700F heat turns it into a steam mass that muffle noise. Each engine uses approximately one quart of steam an hour.

► **Thrust**—Two tubes of 7-in. long stainless steel are mounted in the tail of the pulsejet engine chamber, where they change noise that escapes the steam traffic into a high pitched sound above the level of human perception.

Schmidt claims his silencing system also gives the pulsejet 15-20% greater thrust.

► **Folding Package**—Rotor blades on the new engine have a straight chord of 9 in., are bent to fold at the semi-cord, see-saw link.

When the rotor and landing gear are folded, the Pan-Copter is a small package that can be stored aboard a cargo transport and dropped by parachute into forward combat areas.

The Clark Y model of the engine's rotor blades, made of eight layers of laminated silica paper and seven layers of nylon, may be tapered and manufactured by careful workers on a special machine designed by Schmidt.

A 7-ft blade can be cut in six minutes on this machine, he reports.

► **Pressured System**—Fuel system of the new helicopter is a pressure type up to the rotor head, where it becomes carburetor.

Rotor blades recently have integrally built fuel lines, but they will be removable in the future to facilitate maintenance.

An 18-in fuel tank, located behind the pilot seat, gives the Pan-Copter an endurance of 1 hr-10 min. An air tank of 15-40 lb. air tank is used to start the engine, but centrifugal force keeps the fuel flowing after the engine begins burning.

A bottle containing 52 cu. in. of compressed air is carried for starting purposes.

► **Simple Operation**—Most overhaul of the Schmidt pulsejet after 60 hr. of operation requires less than an hour for each powerplant.

► **Noise vents** are removed by taking out four screws.

► **Valve plate assembly** is lifted out.

► **New assembly** is installed.

Unlike conventional rotary jet units, the Schmidt engines are not attached solely to the rotor blade but are carried on a ball bearing mount that permits the powerplant to swing freely within limits in an open-down position.

Scmidt fits at the tail of the pulsejet and the control-gravity actuating keep the engine in a horizontal position regardless of the angle of attack changes of the rotor blades.

A manufacturer has quoted Schmidt a price of \$85 per pulsejet for the first

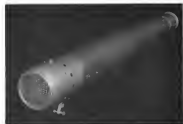
lot at 50 powerplants.

► **Single-Use**—Copter-Schmidt flew his early design helicopter to an altitude of nearly 12,000 ft. in July of last year. The craft was disassembled on a second flight when the designer, unfamiliar with the flying characteristics of his new copter, allowed the air-craft to be blown sideways and tipped over by a strong gust of wind.

But Schmidt says he expects to rebuild the small engine.

► **Adaptability**—Engine—The German-born engineer worked on Fieseler-Wafl's Adigala helicopter before he came to the United States in 1949. He has been employed by several major U.S. aircraft firms during the past 14 years.

Working with Schmidt on the Pan-Copter are T. McGeough, chief engineer of the independent company, and engineer M. Schenker.



British Pulsejet to Power Copters

The pulsejet engine is the most promising means for the propulsion of rotary, says the Helicopter Division of Structures Ltd., British aircraft firm. After a year of experimenting, the company has developed a 45-lb thrust unit that has logged more hours of test and is working on a 120-lb thrust engine.

► **First British Pulsejet**—This is the first British pulsejet to appear in any aircraft, although similar U.S. engines have powered American helicopters' AH-1H and Marguerite's M-14 for some time.

The pulsejet, one of the family of overthrust/underthrust engines that is under the development, was used by the German during World War II to power V-1 buzz bombs.

► **Operation**—A pulsejet engine consists of simple parts. A cylindrical combustion

chamber with a spring-loaded, normally open intake valve, and a tulip.

In operation, a mixture of fuel and air is ejected in the combustion chamber. The resulting explosion forces gas out the exhaust pipe at high speed and closes the intake valve.

The discharge lowers combustion chamber pressure to a point where the spring-loaded valve is able to open again, and a fresh charge of air is sucked and compressed. The cycle then repeats.

► **Acoustic Tuning**—The Structures-Ltd unit is "tuned" by the acoustic properties of the chamber and tulip to a frequency of 138 cycles per second. It can be varied to a minimum of approximately 200 cps or a maximum of 46 cps.

Engine weighs only about 15 lb. for its 45-lb thrust. It is 47.5 in. long, and 5.5 in. in diameter.

PRECISION FASTENERS BY SPS



A typical selection of SPS fasteners. For information, write SPS, Jenkintown 3, Pa.

AIRCRAFT PRODUCTS DIVISION

SPS

JENKINTOWN 3, PENNSYLVANIA

See Right Now: A Glimpse of the Future

South Wind

for aircraft

CONTRACT MANUFACTURING

South Wind's
full-scale space
frame plant, equipped
with the most modern
manufacturing
equipment

from raw materials to shipping dock, South Wind does the job under one roof

Thirteen years as a leading manufacturer of high temperature sheet metal parts and assemblies... many years of meeting rapid requirements for military equipment... strategic location that means low transportation costs... a production base of men and machines that is unique in the industry... facilities for machining, press work, welding, metal finishing and assembly provide complete production—under one roof—every operation subject to one high standard of quality control.

From raw materials to shipping dock, South Wind assumes full and undivided responsibility. Modern material handling methods ensure a steady production flow, while quality control and inspection departments work closely with production to assure delivery of parts or assemblies as specified... on time.

Some typical component parts made by SOUTH WIND for leading aircraft and engine manufacturers

Tail Pipes • Compressor Inlets

Inner Combustion Cases • Oil Reservoirs

Outer Combustion Cases • Variable Nozzles

Combustion Chambers • Afterburner Nozzles



STEWART-WARNER CORPORATION

South Wind DIVISION

AVIONICS Single Computer Combines Flight Data

- AF seeks end of signal sensor duplication.
- Kollsman unit is one solution to problem.

By Philip Klass

The many redundant sensing elements previously used to provide altitude, airspeed, air density and temperature signals needed in fire control, bombing, navigation, and photocon systems appear likely to be replaced by a single central flight data computer in future USAF bombers.

A new Kollsman Instrument Corp. flight data computer (Type C-2), slated for use in two of the USAF's newest bombers, is the first step in that direction.

A more advanced Master Air Data (MAD) Computer which Kollsman is now developing for Wright Air Development Center's Equipment Lab, will provide a still larger variety of flight data signals, including true airspeed, Mach number, barometric altitude, Mach number, and true airspeed.

The C-2 computer weighs 214 lb. and measures 10 7/8 x 11 1/2 x 11 1/2 in., exclusive of shock mounts. The MAD computer is expected to be slightly larger and weigh approximately 25 lb.

► **Operates New Indicator**—The C-2 computer also provides signals for operating USAF's new Type F-4 remission (non-electric) bulk element operating lines position indicator. C-2 computer signals are used to operate two small servo systems whose motor position the Mach number dial and the true airspeed Vee-type indicator on the face of the F-4 instrument. The F-4, with a 5 in. dial, and the similar ME-1, with a 7 in. dial, were developed by Kollsman under contract with WADC's Equipment Lab (Edgley-Phoenix Division of Bendix Aviation has also developed similar remission airspeed indicators).

► **The Need**—Pin control and gumbut computers need to "sense" their own day's airspeed and the density of the air in order to calculate fuel or rocket trajectory. A bombing computer needs



SINGLE SOURCE of airspeed, Mach number and barometric pressure signals is provided by Kollsman flight data computer (left) for a variety of new aircraft equipment.



remission, such as new combined airspeed indicator, Type F-4 (right), which shows pilot indicated and true airspeed as well as Mach number.



ELECTROMECHANICAL calculating mechanism (left) computer true airspeed and Mach number. At right is bay servo potentiometer.



potentiometer which is one of those that are used in the Kollsman flight data computer.

similar information, as well as knowing the plane's altitude.

In most World War II equipment, the barometer, altimeter, or gumbut fed this information into the computer by sending flight instruments and manually setting their readings on a set of dials.

This manual procedure presented the possibility for error, both when the human operator read the flight instruments and when he set in the value observed. If the operator became preoccupied with other duties, the computer operated from incorrect data.

More recently the trend has been toward sensing elements which calculate automatically and automatically correct errors in sensor response, altitude and airspeed signals directly to the computer. For

lack of a single central source of such signals in the airplane, such remission units build into bay equipment the sensing elements he needs, resulting in accurate duplication of sensing elements in large aircraft such as bombers. ► **Chac For AD-WADC** Equipment Lab hopes to eliminate this duplication with a central air data computer, capable of providing signals to a variety of avionics equipment. By so doing, it is possible to provide more data computer design simplification to obtain greater accuracy than is now feasible in individual sensing elements.

Fakes of the single data source will, admittedly, knock out all equipment operating from it. However, two data computers, one a standby, are probably best provided in some type of aircraft at

HIGHLIGHTS IN *Jet Engineering*

**Easier maintenance...
Faster engine changes...
key to increased
operational availability**



Deep performance and power have been built into military aircraft engines must make it constantly available to maintain maximum striking power at all times. This factor—availability—is built into every Westinghouse turbojet. From its first American designed axial-flow jet engine, Westinghouse has improved performance, improved materials and structure by seeking new designs . . . increasing durability and simplifying all parts, assemblies and components. This has lengthened time allowed between overhauls, unattended run-in maintenance, speeded field service . . . and has made it possible for Navy airplane mechanics to change a complete J34 engine and have aircraft returned to operational status in less than an hour!

The McDonnell F2H-2 "Banshee" has shown how these advantages have paid off in U. S. Navy fleet operation. In Westinghouse J34 service record, during combat and maneuvers, contributed to the establishment of aircraft availability levels over 80%. Likewise, U. S. Navy fleets of jet-powered aircraft were made in terms of sorties and hours flown without engine failure.

The more powerful Westinghouse turbojet engines now being qualified and studied for production will offer these same advantages—providing better, more advanced and reliable driving power for both military and commercial jet leadership. Westinghouse Electric Corporation, Aviation Gas Turbine Division, Local Branch P. O., Philadelphia 13, Pennsylvania.

2007



Two Westinghouse J34 turbojet engines power the U. S. Navy F2H-2 "Banshee", helping to give it the high performance that has made it outstanding in Korean combat operations.

YOU CAN BE **SURE**...IF IT'S

Westinghouse



little, if any, weight penalty over its dual-ended design.

- **C-2 Computer Outputs:** All C-2 computer output signals are generated by the widely used 25-v., 400-cps AY281-3-B Astoria, made by Echelon Pioneer Division of Radio Avionics. The 18 signals available from the computer are:
 - True airspeed (true air speed), true altitude
 - Mach number (apparently linear scale factor), true speed
 - Absolute (true) pressure (apparently linear scale factor), true speed

The true airspeed output signals are available in three different linear scale factors. Five of the TAS outputs have a scale factor of 36-deg/100 knots per 100 knots; the other two have scale factors of 50 deg/100 kt. and 60 deg/100 kt. (50 deg/100 kt.).

The barometric pressure scale factor is 3.4 deg/1,000 ft., based on a standard atmosphere relationship.

- **C-3 Accuracy:** Added along the accuracy of its C-2 computer, H. F. Colver, III, Kollsman project engineer, cited the following (for operation through a C-2 to NC (temperature) meter):
 - True airspeed: Less than 1% + 1 ft., with 90% of the error less than 1/2% + 1.5 ft.
 - Mach number: Less than 0.01M, with 90% of the error less than 0.015 M.

The barometric pressure element in the C-2 is specifically designed for use with the F4 converted airspeed indicator to make its Mach number error essentially independent of operating altitude. The model is that barometric

pressure error are larger at low altitudes than in a conventional Kollsman non-true altimeter; in turn they will be in the MAD computer which will have an accurate barometric pressure scale factor for general purpose use.

- **How It Works:** The C-2 is an electronic instrument computer operating from three signal inputs: true pressure, dynamic (pitot) pressure and assumed outside temperature. An externally mounted USAF Type R-4 temperature bulb (developed by Lewis Engineering Corp.) provides the temperature signal input.

First static line, connected to the front of the computer, are routed internally in static and differential pressure circuit. These are duplicate measurements, similar to those used in altimeters and airspeed indicators, each of which draws a small vacuum instead of a positive.

These small static vacuum sources convert the signals from the static and differential pressure switches and the internal temperature bulb into shaft rotation inside of the electronically scaled converting mechanism which in turn drives the output signals.

- **Scale Design:** The three main systems are electrical motor (two-phase, 400-cps) and servo amplifier. The latter employs two subminiature pentodes and two constructed in individual, hermetically sealed, plug-in type cases. The sub mini tubes have provided no reliability problems to date, Colver says, although field exposure is still quite limited.

However, Kollsman promises this need for extreme reliability if the C-2 computer, and its successor, are to achieve wide acceptance. The company has already designed a servo system using half-wave rectifier amplifiers in the input stage for application to the MAD computer; now under development. No-potential amplifiers are potentially more rugged and reliable than tubes.

One source of the magnetic core amplifier such a junction inductor in the first stage, the other version was a silicon tube. Present barometric temperature limitations and lack of reliability make Kollsman reluctant to put it at all with the transistor-amplifier combination. However, the company is hopefully watching new transistor developments.

- **The Future:** Kollsman expects to deliver the MAD computer prototype to WADC early next year. In addition to providing density, temperature, and high-velocity altitude signals, not now available in the C-2, the MAD computer will be designed to operate through a wider range of altitudes and airspeeds.

Despite its advantages, the master air data computer may have tough going in gaining industrywide acceptance. Major problems will be to standardize output signal scale factors, according to Jack Kollman, head of Kollsman's electrical/mechanical engineering department. Many equipments now in production as well along in development have been designed for its own set of scaling elements whose scale factors have been selected for the convenience of the individual equipment. Some manufacturers will be reluctant to change scale factors when it involves even minor redesign.

From the standpoint of the aircraft manufacturer, the master data computer can save installation weight and trouble involved in running individual lines to a variety of individual sensing elements. For this reason, aircraft manufacturers operating under the new USAF weapons systems management plan (Aviation Week Aug. 17, p. 87) may see fit to seek pressure on subcontractors to change their equipment to operate from a master data computer. Time will tell.

Speedy Gyro Delivery

Sanborn Gyro Co., Santa Monica, Calif., can now deliver its Model 69 vertical gyro within 10 days of receipt of an order. Device has a roll rate freedom of 360 degrees, pitch rate freedom of 90 deg, and priority response to within one day. Sanborn says. Gyro weighs 34 lb., operates from 25 v.d.c. and has two 2,000 ohm potentiometer pick-offs.

"Dagwood 6 Calling Danger Forward"



By the way, Bender...

G.L.J. has put his call through new field switchboard since the capacity and controlled the use of the one used by his World War II counterparts.

The new "board" has a construction that can winter in Rejmyr, summer in Woburn, and roll with a push... just in case travel gets rough. Its retractable north knob when to come in out of the rain and go.

Among the many essential parts of this instrument there is one named simply "30GNAL switchboard." It is a 30-megawatt signal, operated by an electric magnet, which "drops" into view when a line is calling. There's no "drop" for each telephone call and circuit, each drop is enclosed in a separate housing made from Superior Hard Drive Carbon Steel MSB C2008—6055" L.D.

Square, .800" wall, 2.656" long. Telephones are close— $\pm .005"$ on the length and $\pm .005"$ — $\pm .006"$ on width.

Mr. Lloyd Bender, Vice President of the North Electric Manufacturing Company, makers of the switchboard, says of Superior, "Your performance has been excellent—in workmanship, quality of material and delivery."

Are you looking for a good small-bulb source—one that gives you the widest choice of bulb analysis available in America today, one that now supply you with one or one-on-one fact, one known for its uniformly high quality, and its interest in you and your tube problems? Try Superior, Superior Tube Company, 2640 Conestoga Ave., Norristown, Pa.

Standard and Special Tubing available in Carbon, Alloy, and Stainless Steel, Nickel Alloy, Inconel, Copper, and Titanium.



Superior

THE NAME IN SMALL TUBING

West Coast Profile Tube Company, 5710 Sutherland St., Los Angeles 23, Calif. (213) 621-1120

81 standard sizes in 1/2" O.D. from analysis in 1/2" wall up to 1/2" O.D.

EAL'S STANDARD PANELS

Between Air Line's light comes will find this new color-coded panel (left) and color indicator panel (right) in the cockpit whether they are flying 60 ft., L-3990 Coordinates or DC-4. The standard panel, designed by EAL, electronic engineering department, was used in improving flight safety and reducing the number of different types which need be studied. The indicator panel is used in EAL's L-799 Coordinates.





As advanced as tomorrow's airliners . . .

Superfine insulation for aircraft

Constant improvement in airplane construction and even-air aircraft design has called for equal improvement in component parts—including insulation material. Pittsburgh Fiber Glass has met modern aircraft requirements admirably with its unusual thermal and acoustical insulating properties. Substantial savings in weight and space can be attained in many aircraft applications.

Turn-key for production line installation, Pittsburgh Superfine Fiber Glass insulation is extremely easy to install with adhesives or tape, and

readily cut with shears, knife, or saw. Both "AA" and "B" grades of Superfine are available in a range of densities, thicknesses and blanket roll sizes and with a variety of borders and facings. Our complete technical staff is at your service for studies and tests on your particular insulating problems. For arrangements, contact our executive offices or district sales offices in Chicago, Cincinnati, Cleveland, Detroit, New York or Washington. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pa.



PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY

EQUIPMENT

Runway Visibility Reporting Improved

- Sperry tells its part in ANDB program.
- Tests show reduction in missed approaches.

By George L. Christian

McKeesport Field, N. Y.—Sperry Corporation Co. has studied the one third rule, an air flight program testing a new system for telling pilots the precise ceiling/visibility conditions they run against at destination (Aviation Week & Space, Jan. 14, p. 46).

Called the "ANDB Low Ceiling/Visibility Program," the project is sponsored by the Air Navigation Development Board, with U. S. Weather Bureau participation. ANDB started Sperry off with a \$134,000 contract (to which \$40,000 was recently added) to help the pilot automatically become the time he saves into his final approach and the time he touches down.

An Sperry spokesman put it: "The project's goal is to let the pilot know precisely when he can transfer from instruments to visual reference and to describe as accurately as possible the meteorology of the situation as it exists at an airport at any given time."

■ **Right Approach**—Used in the new program are a new, continuous-reading altimeter and a transponder, respectively they tell the height of the cloud base and the height of the atmosphere at the threshold of the instrument runway.

Tests experimentally in conjunction with improved, indeed dramatic, weather reporting techniques at Washington National Airport, those devices have reduced missed approaches from 6.5 to 1.5 in the past year, according to CAA officials. Apparently they were made with visibility of less than one mile.

The only other existing installation is here at McKeesport Field, Scrabble, Pa., where Sperry stations an experimental Right Approach Ref. 15 additional sets are on order, of which three will be installed at Leeward, Newark and Idlewild fields in the New York area, and the remaining 12 at other critical airports in the U. S.

Many agencies are interested in the low ceiling/visibility program, in addition to ANDB (representing all branches of the military services) and



SPERRY UNIT DC-4 is an improved weather reporting technique.



INTERIOR VIEW of plane shows work centers and other recording equipment.

the Weather Bureau. The Civil Aeronautics Administration, Civil Aeronautics Board and the military all are following the work closely.

When put into operation, the Sperry system could not only be used for landing safety, it could make approach under bad weather conditions more efficient, permitting pilots to land at shorter intervals.

■ **Significant Differences**—Giving impetus to the low ceiling/visibility program was the knowledge that significant differences exist between ceiling

and visibility reported to serving pilots by the tower and actual conditions as they exist during final approach and at the runway threshold. Usually half a mile from the control tower—often much farther.

Moreover, while prevailing methods of weather reporting, considerable time was elapsing between the moment a weather reading is taken and the time a pilot is given the report.

So instruments were developed and a system devised whereby a pilot would be furnished with short-continuous,

REPORT TO OUR ADVERTISERS . . .

Eight months of progress climaxed by the biggest issue and the biggest month in AVIATION WEEK history . . . a record 427.57 advertising pages for August 1953.

AVIATION WEEK believes that its advertisers—an audience that continues to grow substantially with each passing month—are due a progress report on their favorite magazine.

We have just published a record 454 page issue, the August 17 edition, as well as the biggest advertising month in Aeronautical publishing history. The August advertising figure, 427.57 pages, as well as AVIATION WEEK's eight months 1953 total of 2,344 advertising pages represents more space than the combined total of the next three Aviation publications. With this whopping total AVIATION WEEK for the second year heads for that select group of young and old pros comprising the 35 largest consumer and business magazines in the nation. Heady stuff!

This solid achievement of AVIATION WEEK is further spelled out by its uninterrupted progress to record industry acceptance and advertising volume, a fact convincingly illustrated by its yearly advertising figures: 1950—1,630.82 pages, 1951—2,541.95 pages, 1952—3,240.07 pages, 1953—3,425 estimated pages. With volume such as this, it becomes futile to speak of rate of growth comparisons. From 50 to 100 pages monthly represents a 100% gain, but the net result is something less than substantial in terms of industry potential. In publishing perspective, a gain from 235 to 250 advertising pages a month—a 7.7% gain—which on first inspection does not sound so impressive, is far more to be desired. Experienced buyers of magazine advertising space happily are in the know as far as Aviation space is concerned. They pay little, if any attention, to such percentage comparisons. Long ago they marked them as deceptive and unreliable unless such claims were advanced where equal or near equal advertising volume was involved. In the Aeronautical field the advertising leadership of AVIATION WEEK has been unchallenged and uninterrupted for many years . . . year after year this publication has published more than the combined total of the next three publications.

Advertising figures such as these, however, tell only a partial story of AVIATION WEEK

progress. Along with them go the expansion of our editorial services, with a staff now numbering 18 full-time editors, skilled Engineering and News specialists recognized throughout the industry. In the last eight months, in addition to their regular AVIATION WEEK writings, products of their talent have appeared in the SATURDAY EVENING POST, READERS DIGEST, HARPERS Magazine and on Major National Television Channels. Their achievements are ones in which we take considerable pride. They are an indication of the caliber of our staff. Supplementing their services are eight domestic News Bureaus, the services of Press, Inc., subsidiary of the Associated Press, Inc., foreign news offices in London, Paris, Frankfurt, Manila, Mexico City, Sao Paulo and Tokyo, and correspondents in the principal cities of the world.

This heavy concentration of editorial talent and resources has resulted in the building of a reader preference unique in the business publication field. It is a record that has been exhaustively tested by the industry itself through their own reader preference studies. Of twenty-seven conducted through engineering and management departments, customer lists and directories AVIATION WEEK has won them all—and not closely but by a better than 4 to 1 average. It is our standing offer to any manufacturer to conduct his own reader preference study, if he wants to get at the facts of reader preference and magazine pulling power. We'll gladly pick up the check, if he desires. This record of reader preference has stood for years, increasing in momentum, and explains why when orders and inquiries of merit are wanted, AVIATION WEEK is always first at bat.

Our growing audience of AVIATION WEEK paid subscribers (\$8.00 per year) continues to rise significantly. There are 10,000 more on the books since last year, making up a current total of over 45,000 not paid subscribers. (42,743, 8/30/53 ABC statement). Likewise our book-value rises importantly as indicated by our all-time high renewal percentage.

These facts and figures should serve in some small measure to make clear AVIATION WEEK's position among the powerful, independent publications of today. They are furnished to you with a deep sense of gratification because through you we were able to achieve them.

AVIATION WEEK
A McGRAW-HILL PUBLICATION—ABC-147

Look to the Sky for Your Market



McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42 STREET, NEW YORK 36, NEW YORK

Other Advertising Sales Offices: Atlanta, Ga.; Boston, Mass.; Chicago, Ill.; Cleveland, Ohio; Dallas, Texas; Detroit, Mich.; Los Angeles, Calif.; Pittsburgh, Pa.; Philadelphia, Pa.; San Francisco, Calif.; St. Louis, Mo.; Seattle, England



COCKPIT MOVIE CAMERA records pilot's view of approach visibility.



GROUND STATION secretly records weather readings and specifications then on tape according with flight crew's observation on actual visibility conditions.

up-to-the-minute information as the meteorologist at the airport.

Now, with the program still in its infancy, transmission timing readings show experimental weather stations to achieve cloud base increases with high precision; they can predict to a pilot descent exactly when he will break out of the clouds as long as seven to eight minutes in advance of the critical moment when he has to decide whether to land, go around, or proceed to an alternate.

GSA observers estimate that with the advent of commercial jet aircraft, the time prediction element may have to be increased to as much as 20 minutes.

Old-style colorimeters gave a reading every six to 12 minutes. But colorimetry of 100-400 ft in 12 seconds has been provided, as colorimeter readings often were unreliable.

► The Tech-Agencies has assembled an electronics army on the ground and in the air to integrate the services in such operations as:

- Where did the light come from on the ground, vertically below?
- Did they see the approach lights, and when?
- When did they see the threshold of the runway?
- Where along the approach path was the plane at this time?
- On the ground—this is the ground step.

On the left side of the threshold of the instrument runway was a team of three men: a ground observer for meteorological visibility, who determines ceiling height as high (using ball-balloon), a ground observer for runway visual range and background brightness, and a ground test engineer who works in a Weather Bureau station established at the end of the runway and outlines the observations of the two ground observers with instrument readings of his own. He is given ceiling data by the colorimeter every 12 seconds. He is furnished accurate indications of brightness as visibility by the transmission, and an accelerometer and

size give him wind velocity and direction.

All this information is transmitted to the tower at frequent intervals for transmission to pilots in the vicinity.

Here are the tools these men have to work with:

► **Colorimeters.** They use version of the machine used to measure ceiling has two basic advantages over previous models. The projector shines through 500 deg. (see a horizontal seal every 12 sec., giving an almost continuous indication of height of cloud base, and it may be read remotely.

The colorimeter's projector and a detector are two hundred feet apart. The projector shines a 200-foot beam of light to the cloud base. A rotating hard-type shutter modulates, or interrupts, the light beam 150 times a second to distinguish it from street, airport and other lights. Later models of the projector will have two lights, back to back, resulting in a reading being taken once every six seconds.

The detector consists of a square box about five feet on a side. In the center, facing up, is a heavily polished, prismatic reference projected from the elements by a heavy piece of glass. Modulated light rays from the projector, reflected from the cloud base, are caught by this reference, fed to a photoelectric cell, then to an indicator device which automatically calculates the angle formed by the projected light beam on the cloud base. The angle is read from an indicator located in the ground test engineer's shack at the end of the runway. By consulting a set of tables, the engineer may quickly convert the colorimeter angle to a specific height which is commensurate to the tower.

Current tests at Washington Field use two colorimeters. First is located 3,480 ft. from the threshold of the instrument runway, second is the main base, 3,200 ft. from the end of the runway. Spacing technicians are currently evaluating the best location for the colorimeter.

► **Transmissometer.** This instrument, developed by the Bureau of Standards, is also made up of a projector and a detector. The projector, located 200 ft. apart at the instrument runway threshold and is parallel to the runway. Projector shines a beam of light on a photoelectric cell in the detector. Intensity of the light beam is shown on an indicator in the ground station as an instrument scale calibrated from 0 to 100 to indicate visibility along the runway. Transmissometer cost about \$1,600, colorimeter about \$7,000. Total cost, including installation, now about \$12,000.

► **Visibility markers.** A series of visibility markers extend along the field as an arc from the ground station. The size of the 11 rectangular, black markers

becomes gradually larger with increasing distance from the observer. This gives the observer first they see all the same size and ready in three subdivisions the same angle from the observer's eye. Each marker is illuminated by a 25-watt bulb for nightwork.

► **Pyg test markers.** Black-and-white pyg test markers are spaced on both edges of the runway along its entire length. With the standard, parallel-line detector instrument pointed at intervals along the runway, these pyg check points along the runway work which to gauge visibility to the ground observer for runway visual range.

The observer stands on a removable ladder and takes a reading each time a plane lands. The ladder gives the height of his observation to approximately that of the pilot's eye level.

Also measured are wind direction and velocity, and sky brightness is measured by a photometer.

All observations between ground station and aircraft pilot are tape-recorded. ► In the Air-Agencies has equipped a DC-3 with various instruments and cameras to check "brightness" data which in conjunction with actual object brightness measurements, will serve as a basis for the determination of instantaneous transmission of the atmosphere between the aircraft and the ground.

The first camera views exclusive pilot's field, instrumentations cameras (for visible terrain and cockpit) movie camera, transmission engineer (for photo panel and graphic recording) and a light test system.

There are the camera and instrument mounts provided the light test crew.

► **Visible terrain camera.** Really two units in one, the visible terrain camera is mounted in a blower protruding from the left side of the DC-3's fuselage just below the pilot's line of vision. It is accessible from inside the aircraft.

The camera has but one shutter and film, but is equipped with two lenses. Main lens is 14 deg. wide-angle unit. It is directed to photograph from 10 deg. above the horizontal to 20 deg. from dead vertical, and from 10 deg. to the right of the nose of the aircraft to 70 deg. to the left. Purpose of the camera is to photograph at each of the terrain which the plane is approaching as possible.

Special filters matched to the film give it the utmost spectral sensitivity in the ultraviolet range.

Inside the camera is a second lens focused on an illuminated "gray scale" showing all gradations of gray from white to black. The gray scale is simultaneously recorded on each exposure of the visible terrain except for the comparison of grayscale gray with the gray of the terrain being photographed. It also serves to correlate density of ultraviolet of the photographic film to

Now...Back-up Rings made from stress-relieved Teflon*



► A unique method of processing Teflon resin releases internal strains without reducing porosity in "Fluoroflex-T" products—thereby providing maximum dimensional stability and tensile strength.

Starting with virgin, unrecrystallized Teflon powder, all manufacturing operations are under a strict quality control and inspection system approved by the USAP under MIL-Q-9852 specifications. This assures production of Fluoroflex-T products which are in conformance with AMS-2041.

When you look up "T" ring seals with these Fluoroflex-T anti-extrusion rings, you can be sure of optimum performance and maximum operating life, even in larger sizes.

WORKING ADVANTAGES OF FLUOROFLEX® BACK UP RINGS

1. They withstand up to 500°F without decomposition.
2. They are chemically inert to acids, alkalis, solvents, and natural or synthetic oils.
3. Self-lubricating, they reduce friction and stresses on the "O" ring.
4. Non-frying, they cannot cause malfunctioning of other components in the system.
5. Their spiral construction simplifies installation.

Fluoroflex-T spiral rings are designed in a complete range of sizes for use with AMS-2041 and AMS-2042 "O" rings. Write for Bulletin PF-1.

*Fluoroflex-T rings made for use in fluoropolymer systems.
Fluoroflex-T rings made for use in products of other fluoropolymer resins.

RESISTOFLEX corporation

Belleville 9, N. J.

has EVERYTHING... FOR TESTING FUTURIZED AIRCRAFT CABIN LEAKAGE



ENGINEERING ASSOCIATES MODEL 1000

IN USE WITH LEADING

AIRCRAFT COMPANIES!

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

with E.A. designed equipment.

Calder pressure leakage equipment

meets and seals efficiency tests

and tests quickly and accurately

the grey side and thus eliminate variation in any results during film development. In other words, the grey side permits measuring absolute instead of relative brightness.

They still camera, triggered by an intervalometer, takes pictures at two second intervals during an approach. It usually takes on average of 40 shots during one run. The exposures which trigger the visible terrain camera also serve to synchronize all other events and always leave in the air, not by radio signals, the airborne observations are timed to all ground events and observations.

The camera is also equipped with an independent photometer which measures average brightness in a 15-degree field about it and on the same area as the lens. Located just above the camera, the photometer serves as an independent check of the unit's operation.

• **Weight mobile camera.** The 35 mm unit, mounted between pilot and co-pilot, makes a continuous photographic recording at approximately what the two pilots see through the windshield. It is also provided with a photometer which records brightness in a 15-degree field centered on the axis of the movie camera's lens.

• **Photo panel recording camera.** Located in the forward part of the main cabin, this camera measures directly and standard readings in speed, altitude, location and photograph indications, clock, outside air temperature, and indications from a cloud detector mounted outside the airplane. It also measures moisture content of the air through which the plane is flying.

In the lower right-hand corner of

the panel are nine small lights which act as speed read indicators. Besides and to the camera make a permanent record of such events as the plane's roll and pitch, brightness meter readings, etc.

• **"Spary Weather."** To date, Sperry never "sparked" out of its "Spary weather," have operated over 150 flights through altitudes of 800 ft. or lower.

They hope to conduct 500 such flights before the final flightings are turned in to ANDD and the CNA.

Load-Dumping Valve Aids Crop Dusters

Crop-dusting planes may find it easier to get out of bind crossovers and other tight spots with a new dump valve for jettisoning spray loads.

Originally designed for timber-spraying work by Central Aircraft, Inc., the valve reportedly has been installed and used with success in aircraft spraying of all kinds of crops.

Body of the unit is in aluminum cast with a 5-in. inside diameter. It is mounted opening and both dump and self dump approximately 90% of a fully loaded 300-gal tank in 5 to 6 seconds.

The lid is made of cast aluminum and is held in place by an over-center clasp which is designed to withstand 700-lb. pressure from within. For release, a 3/8 pull on the clasp arm flips the valve to wide-open position.

The unit can be mounted on any vehicle having a 3-in. diameter size of 60 or 80 in. tank.

Central Aircraft, Inc., Box 1164, Yakima, Wash.

These highly specialized aircraft motors are engineered for the particular demands of the particular where locally applied positive action power is necessary. U.S. Motors is one of the pioneers of high frequency vibration type aircraft motors and has accumulated much in research, testing and application record to none.



U.S. AIRCRAFT MOTORS

Features:

- ALTERNATING CURRENT—3-PHASE, 480V, 1500 RPM
- 2-1/2 TO 14 HP—400 CYCLES UP TO 30 000 RPM
- INSTANTANEOUSLY A CONTINUOUS RUN
- DRIVE OR GEARED STEPS
- NO SHAFT VIBRATION
- HIGH TEMPERATURE RESISTANCE
- TYPING TO 30 000 FEET ALTITUDE
- PROTECTED BEARING
- HAFT CONTACT DISPOSE
- EACH DESIGN SPECIALLY ENGINEERED
- CONFORM TO OFFICIAL SPECIFICATIONS
- 1/2" CONNECTORS OR SPECIAL LEADS

Alcohol No. 2 Electrical Motors for
See 2000 Low Voltage 10 1/2" or 10 1/2" or 10 1/2"

NAME _____
COMPANY _____
ADDRESS _____
CITY _____ STATE _____

MAIL COUPON FOR BOOKLET
U.S. ELECTRICAL MOTORS Inc.

Los Angeles 34, Calif. (Box 2000) or Milford, Conn.

New, Sensitive SHUTTLE VALVES



REMARKS: In particular, sensitive shuttle valves have been developed for use in aircraft. They are used in a variety of applications, such as in the control of fuel, oil, and other fluids. They are also used in the control of air flow in the engine and in the control of the landing gear.

FEATURES: Sensitive shuttle valves are used in a variety of applications, such as in the control of fuel, oil, and other fluids. They are also used in the control of air flow in the engine and in the control of the landing gear.

CONSTRUCTION: Sensitive shuttle valves are constructed of aluminum and are designed to be used in a variety of applications, such as in the control of fuel, oil, and other fluids.

REMARKS: Sensitive shuttle valves are used in a variety of applications, such as in the control of fuel, oil, and other fluids. They are also used in the control of air flow in the engine and in the control of the landing gear.



B-52 UNDERGOES FLOW TESTS

Left wing on large Boeing B-52 Stratofortress is painted black to provide effective contrast with white smoke steps used during flight tests to check airflow characteristics. Ground-level tests previously used were too small for effective photography from altitudes above 45 ft. up on bomber's skin, hence switch was made to 1/2-in. wide strips against black background.

Also, instead of the single camera formerly used, two were installed for the tests. Aeronautics testing office of extended color and colorless light systems. View of left wing making is region of splices normally used the lateral camera. Aeronautics wing testing office between left splices probably to be lateral method system but for use by suboptimal system.

Warner "Know-How"



The "Know-How" to Mass Produce Precision Hydraulic Equipment

The hand pump shown above is a typical example of Warner's ability to mass produce precision hydraulic equipment. This pump is used in connection with a special ordinance application requiring high volumetric efficiencies and must be produced to very close tolerances.

Warner is qualified by experience and facilities for the design and production of hydraulic equipment for a wide range of uses.

Warner engineers will welcome an opportunity to assist you in the development of special hydraulic equipment to meet your particular requirements.

Send for your copy of an illustrated folder describing typical examples of Warner Hydraulic Equipment.

Warner DIVISION OF DETROIT HARMSTER CO. OF N.Y. INC.
25155 GROESBECK HIGHWAY • P.O. BOX 386 • DETROIT 5, MICHIGAN
DESIGNERS AND MANUFACTURERS OF PUMPS • VALVES • ACTUATORS



OFF THE LINE

New birthable suit, developed by Hershman Tool and Engineering Co., will be used as lounge at Air India Super Constellation and all cabins of Douglas Super Constellation, Hershman says.

Utility meet let for airline passengers, called the Sky Guest Fix, is being offered as a professional device for airlines. It contains a number of top-level items useful for the passenger's personal grooming and convenience. Products include shaving mirror, blades, toothbrush, comb, toothpaste, tissues, etc. Times World Airlines distributes the kit on its scheduled main and supplement with other carriers on order. Most of the cost is borne by the manufacturers of the individual items contained in the kit, with the result that the user can be offered to carriers for the seasonal price of box top, printer, headline, and Sky Guest Fix Corp., 17 E. 42 St., New York, N. Y.

Post of New York Authority's Bell helicopters just can't do without that TCP, Skiff's emergency fueling additive. The plane may take more than 100 gallons in two years of TCP. One year will be put right for 5 gal. of fuel, the other for 30 gal. So if the pilot has to fuel at some location where the additive is not available, he just adds his own.

A 50% reduction in delays due to ignition trouble is realized by E. I. du Pont de Nemours and Co. of Scarsdale, N. Y. The Vapex type is used in the automotive market as a permanent installation in its three Constellation.

Patented pressure-sensitive tape is said to have made scientific work, not only for fluid flow identification, but as all sorts of tape and have been used in the Vapex type is used to coat valves, according to the manufacturer, Pineda Colophony Tape Co., 521 N. La Brea Ave., Los Angeles.

Seat Investment

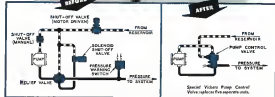
Cost of constantly underwriting on airline fleet is pointed out by Delta-CRIS Air Lines, which estimates that each of the 60 passenger seats in new Douglas DC-7s an order represents an investment of \$26,180. In 1961, the carrier's DC-7 equipment represented a capital investment of approximately \$1,760 per seat. Each seat in its new Convair 440 represents an outlay of \$13,638, Delta says.

CUSTOM-BUILT

VICKERS VALVE...

- ★ SIMPLIFIES HYDRAULIC SYSTEM
- ★ REDUCES FIRST COST
- ★ SAVES WEIGHT
- ★ REDUCES MAINTENANCE COST

Vickers Model AA-4050 Pump Control Valve (10 gpm)



This special 5-4-1 valve was developed for use where it is desirable to individually control each of several pumps. It will automatically unload the pump delivery at a low pressure into the suction side when the oil temperature has reached a predetermined maximum. The design includes manual unloading of the pump. Maximum system pressure is limited by a built-in relief valve. A pressure-actuated electric switch is provided for use as a signal option to flag system pressure changes. The manual pump shut-off control also serves as a flow-out shut-off device.

As used on one four-engine airplane, this accessory reduced the number of separate hydraulic units from 34 to 4 and eliminated four electrical switches, 8 unions, many standard threaded parts. Replacement of multiple accessories by the single valve reduced procurement costs by about 65%, this does not include savings due to the simplified piping. The weight saving was also significant. For further information, write for new Bulletin A5230.

Vickers designs and manufactures a great variety of special hydraulic controls for aircraft. Call on us with your problem.

VICKERS Incorporated • 1462 OAKMAN BLVD., DETROIT 32, MICHIGAN 48221

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



Aircraft Controls

completely integrated, highly sensitive remote positioning systems for a wide variety of controls needed throughout today's aircraft

To meet the constantly growing need for remote control of various components on today's complex aircraft and missiles, Barber-Colman Company now makes three types of positioning systems.

Each is a complete system. Listed below in order of increasing complexity, outstanding features of each are as follows:

BASIC REMOTE POSITIONING—Ideal for moderate speed control applications. Basically a d.c. bridge with transmitting and receiving rheostats. Detector is energized by self-exciting polarized relay which detects imbalance signal. Simplicity and ruggedness are important features for long life and ease of maintenance.

HIGH-SPEED POSITIONING—Differs a unique

velocity feedback circuit directly to end of drive motor's polarized relay. Simple adjustment of percent of feedback permits actuator speeds up to 90° per second, with any degree of damping. Over travel or hunting may be completely eliminated.

ELECTRONIC HIGH-SPEED POSITIONING—For applications requiring the utmost in position accuracy at any speeds. Extensive circuit research has produced an extremely simple, lightweight control resulting in maximum performance. Available for operation with either low or high impedances, a.c. or d.c. inputs.

Whenever you know a need for remote positioning controls, consult Barber-Colman engineers for the system best suited to your application. Send coupon below for details.

Typical uses of Barber-Colman Remote Positioning Systems

Temperature Control Mixing Valves
Turbine Control—direction and rotation
Flap Control
Rudder Control
Hydrocylinder Control
Servo Controls and Computers
Jet Fuel Pipe Drifts Control
Cannon Aim Control
Propeller Pitch Control
Nose Wheel Steering Control

plus many other classified applications



COMPACT, LIGHTWEIGHT, HIGH-SPEED SYSTEMS
WITH MAXIMUM SIMPLICITY FOR DEPENDABLE,
ACCURATE POSITIONING

TYPICAL ELECTRONIC CONTROL BOX—Note the compactness of component. Unit measured in complete aircraft control, including two stable pots in double throw output relays. Does exactly listed in new requirements of MIL-STD-883C in 100 hr. Approximate weight 2 lb. 8 oz.



Aircraft Controls

Aircraft Controls • Automatic Controls • Instrument Instruments • Seal Motors • Air Distribution Products • Gyroscopes and Operators • Manual Controls • Metal Cutting Tools • Machine Tools • Textile Machinery

BARBER-COLMAN COMPANY, ROCFORD, ILL. U.S.A.
Dept. 6, 1402 Rock St. • Field offices in aircraft centers
Overseas: Please send data in this position: (attach

Name _____

Firm Name _____

Address _____

City _____ State _____

through the

fabrication barrier

solving the
fabrication problems
of jet engine components
through the
precision and skills
of experts



In the design, engineering
and fabrication of jet engine
components and assemblies,
TWIGG INDUSTRIES, INC.
coordinates the skills of
expert craftsmen with
the right demands of the
aircraft industry for precision
parts . . . delivered on time!

TWIGG

TWIGG INDUSTRIES INC.
INDIANA

combustion chambers
compressor casings
turbine casings
tail cones
burner supports
inlets
all type injection
tube bending
other essential
components

NEW AVIATION PRODUCTS



B-47 Shut-Off Valve In Mass Production

A new 13-in. motor-actuated fuel shut-off valve for the B-47 has been put into mass production. Developed by Standard-Thomson Corp., the unit will be manufactured at the company's Dayton plant until November, when production will be shifted to a new plant near Vandalia, Ohio.

Outstanding features of the valve, according to Standard-Thomson, is a cam-operated mechanism which actuates the actuator from the valve gate just before the gate is cut in motion. A stop remains selected until gate is returned to closed position. Both rings are lapped with soft, synthetic rubber.

An over-ride mechanism in the actuator, which provides positive positioning of the gate, is another improvement cited by the company. It disengages the actuator from the gate as full open or full closed position, at the same time providing for jammed or over-actuated.

The number of valves installed throughout the fuel system of each bomber will vary from 11 to 16, depending on the model. Each of these will be able to carry a load of up to 2,000 gallons of fuel per hour in either direction at inlet pressures as high as 60 psi and will be required to operate satisfactorily at minus 65° to +150° ambient temperatures.

Made for the unit is a single pop action/overhaul type powering a conventional, planetary gear actuator.

Standard-Thomson Corp., 216 South Main St., Dayton 2

Insulating Polymer Raises Electron Tube's Altitude

By using Kofel polymer as the socket insulation and insulating the insulating harness on the socket base, an electron

Everything's Under Control with **DRIVES** and **TRANSMISSIONS**

by



90° ACTUATOR DRIVE
For direct connection to actuator
that provides linear actuating



TORQUE TURN DRIVE
For actuating torque
between torque tubes and flexible shafts



90° BEAM
Precision casting, flexible
ball bearing supports
lubricated and insulated



TEE DRIVE
Directly geared
for maximum
torque in series

OTHER BREEZE PRECISION PRODUCTS

Special Electrical Drives
Chemical Mechanical
and Hydraulic Actuators
Ignition Timing
All Types of
Flexible Metal Folding
Auto-Feed
Warm Drive Run Gears

• To actuate tabs, flaps, shutters and other aircraft mechanisms with positive, precision control, the industry long has relied on Breeze drives and transmissions. From simple mechanical drives and direct reading indicator drives to electrical and hydraulic actuators, Breeze offers a complete line, affording a wide choice of components and assemblies to meet many individual design needs.

Shown here are examples of Breeze-engineered lightweight mechanical drives, having connections to mate with flexible shaft drives. The 90° and TEE drives may be mounted in any position with relation to an actuator mounting.

Inherent in all these designs are features dictated by specific aircraft needs and experience. You may find the assemblies you require in our wide variety, thus saving design and tooling costs. Or, our engineers will design and custom build for your special requirements.

We invite consultation. Write for our complete informative catalog.

BREEZE
CORPORATIONS, INC.

40 South 8th Street, Newark 7, New Jersey

If you use relays—Clare's New Plant is

**CLARE RELAYS are now built in the
most modern plant ever specifically designed
for relay manufacture**

BIG NEWS!



Light eight times better than average for industrial plants—25 foot candles at overhead—proof light at bench level.



Also automatically welded—avoids danger of contact failure in such operations as contact welding.



100% inspection of all Clare relays with most modern test equipment. Light as this test set gives 25 foot candles.

• Building of precision relays requires more than technical skill. It requires an atmosphere of utmost freedom from dirt. Air temperature and humidity must be closely controlled. Assembly of small parts must be done under powerful, yet shadow-free light.

All these important features and many more are provided in the new Clare relay plant. Never before have so many manufacturing advantages been provided in one plant—for one purpose—to give you relays of unequalled quality.

Quality and long-life dependability of Clare relays have made them first choice of designers as components for critical equipment. Whenever failure cannot be tolerated, when only the best is good enough, Clare relays are indicated.

Two important factors contribute to this Clare superiority. Production of relays has always been the exclusive business of

C. P. Clare & Co. This is a young-minded progressive organization, ever alert to discover and test new and better materials and manufacturing methods.

The new plant is the product of years of research and experiment. It is the natural development of Clare's unwillingness to offer their customers anything less than the most perfect relays that can be built.

If yours is a product whose long life, reliable performance and freedom from maintenance depend on the use of relays—it will pay you to know ALL about Clare relays. A sales representative, fully experienced in every type of relay problem, is located near you. Consult him, or write C. P. Clare & Co., 4719 West Sunnyside Avenue, Chicago 30, Illinois. In Canada: Canadian Line Materials, Ltd., Toronto 13. Cable Address: CLARELAY.

CLARE RELAYS



Automatic testing of all test points and humidity tolerance accuracy of assembly and adjustment of delicate parts.



Multiple test checks of bench clean relay test fixtures adjusting all relay to customer's specific needs.



Derivative parts of high frequency relays require microscope assembly conditions.

**FIRST IN THE
INDUSTRIAL FIELD**

Friendly Service

—the World Over!



WITH a Secor-Vacuum credit card in your wallet, and Flying Red Horn aviation products in your plane, you're sure of friendly credit-top-flight performance wherever you fly.

Secor-Vacuum credit cards are honored at hundreds of airports here and abroad... can be used for all Flying Red Horn aviation products. Always hand at the Sign of Friendly Service!

Mobil Oil Products Co. Inc., Dept. 1, and Advertisers: Mobil Oil Products Co. Inc., General Aviation Division, Chicago.

The Best Pair to Get You There!

the's altitude ceiling was raised 15%, reports M. W. Kellogg Co., producer of the plate.

The company attributes this mainly to the high dielectric strength of KClF (trifluorochloroethylene) which protected insulation and screens which formerly relied on one of the tube at higher altitudes. High mechanical strength of the plate enables the electron tube frames to be made thin, yet capable of withstanding heavy shocks and vibration. The tube socket is injection molded by the Elco Corp., Philadelphia.

M. W. Kellogg Co., Jersey City, N. J.



New Hydraulic Pump Motor Developed for Jet Bombers

General Electric Co. has come up with a new air-cooled 34-gal. hydraulic pump motor for jet bombers.

Developed by the company's specialty engine sub-division, the unit is rated at 7,500 rpm. Functioning as a supply hydraulic power for control of the aircraft's fuel assembly, and in the wing area as a standby source of power when the jet is the primary motor.

The nature is of the duct-type, employing an air-throat design which admits air from outside the plane, circulates it through the blades and winging, and expels it from the gallery end.

According to GE engineers, the air-throat design is much more effective than the old air-over arrangement because it allows air to be brought directly to the primary source of heat, the engine and compressor.

GE lists as important features of the motor it can operate in air from about 65 to plus 155° at altitudes approaching 90,000 ft. It is oil-cooled through the use of two blow-by tubes connecting via ducts to the static air; it has a three-to-one gear reduction; it is equipped with a radio noise filter; condenser tubes on its side draw heat out of the motor.

General Electric Co., Schenectady 5

SPECIFY ADEL

FOR THE BEST IN ANTI-ICING EQUIPMENT

ADEL anti-icing equipment is designed, engineered and precision-built for maximum performance and dependability. Today, ADEL equipment is on the lower aircraft because ADEL has the proven ability to better serve the industry.



Field-Mounting Pump Drive "M" with capacities from 2 to 18 GPM at 28 psi, 275 V.D.C. 1/2" NPT, length 10" Weight 275 lbs. Single and dual motor types. Meets all anti-icing requirements.

Filter-Miscible Series 12755 flows and freeze protection as small as 2 inches out of ducts and anti-icing and fuel heater system fluids. Aluminum body, easy to clean. Largest filter area available for size and weight (3 1/2 ft.).



Low-Pressure Check or Relief Valve Series 8382 widely used in fuel heater and engine systems. Heavily reinforced. Operating pressure range from 4 psi to 100 psi. Capacities to 55 GPM at 50 psi.

Low-Pressure Shut-off Valve Series 12257, standard mounted, for burner flow control in anti-icing and related systems. Series 12440, 12441, 12442, 12443, 12444, 12445, 12446, 12447, 12448, 12449, 12450, 12451, 12452, 12453, 12454, 12455, 12456, 12457, 12458, 12459, 12460, 12461, 12462, 12463, 12464, 12465, 12466, 12467, 12468, 12469, 12470, 12471, 12472, 12473, 12474, 12475, 12476, 12477, 12478, 12479, 12480, 12481, 12482, 12483, 12484, 12485, 12486, 12487, 12488, 12489, 12490, 12491, 12492, 12493, 12494, 12495, 12496, 12497, 12498, 12499, 12500, 12501, 12502, 12503, 12504, 12505, 12506, 12507, 12508, 12509, 12510, 12511, 12512, 12513, 12514, 12515, 12516, 12517, 12518, 12519, 12520, 12521, 12522, 12523, 12524, 12525, 12526, 12527, 12528, 12529, 12530, 12531, 12532, 12533, 12534, 12535, 12536, 12537, 12538, 12539, 12540, 12541, 12542, 12543, 12544, 12545, 12546, 12547, 12548, 12549, 12550, 12551, 12552, 12553, 12554, 12555, 12556, 12557, 12558, 12559, 12560, 12561, 12562, 12563, 12564, 12565, 12566, 12567, 12568, 12569, 12570, 12571, 12572, 12573, 12574, 12575, 12576, 12577, 12578, 12579, 12580, 12581, 12582, 12583, 12584, 12585, 12586, 12587, 12588, 12589, 12590, 12591, 12592, 12593, 12594, 12595, 12596, 12597, 12598, 12599, 12600, 12601, 12602, 12603, 12604, 12605, 12606, 12607, 12608, 12609, 12610, 12611, 12612, 12613, 12614, 12615, 12616, 12617, 12618, 12619, 12620, 12621, 12622, 12623, 12624, 12625, 12626, 12627, 12628, 12629, 12630, 12631, 12632, 12633, 12634, 12635, 12636, 12637, 12638, 12639, 12640, 12641, 12642, 12643, 12644, 12645, 12646, 12647, 12648, 12649, 12650, 12651, 12652, 12653, 12654, 12655, 12656, 12657, 12658, 12659, 12660, 12661, 12662, 12663, 12664, 12665, 12666, 12667, 12668, 12669, 12670, 12671, 12672, 12673, 12674, 12675, 12676, 12677, 12678, 12679, 12680, 12681, 12682, 12683, 12684, 12685, 12686, 12687, 12688, 12689, 12690, 12691, 12692, 12693, 12694, 12695, 12696, 12697, 12698, 12699, 12700, 12701, 12702, 12703, 12704, 12705, 12706, 12707, 12708, 12709, 12710, 12711, 12712, 12713, 12714, 12715, 12716, 12717, 12718, 12719, 12720, 12721, 12722, 12723, 12724, 12725, 12726, 12727, 12728, 12729, 12730, 12731, 12732, 12733, 12734, 12735, 12736, 12737, 12738, 12739, 12740, 12741, 12742, 12743, 12744, 12745, 12746, 12747, 12748, 12749, 12750, 12751, 12752, 12753, 12754, 12755, 12756, 12757, 12758, 12759, 12760, 12761, 12762, 12763, 12764, 12765, 12766, 12767, 12768, 12769, 12770, 12771, 12772, 12773, 12774, 12775, 12776, 12777, 12778, 12779, 12780, 12781, 12782, 12783, 12784, 12785, 12786, 12787, 12788, 12789, 12790, 12791, 12792, 12793, 12794, 12795, 12796, 12797, 12798, 12799, 12800, 12801, 12802, 12803, 12804, 12805, 12806, 12807, 12808, 12809, 12810, 12811, 12812, 12813, 12814, 12815, 12816, 12817, 12818, 12819, 12820, 12821, 12822, 12823, 12824, 12825, 12826, 12827, 12828, 12829, 12830, 12831, 12832, 12833, 12834, 12835, 12836, 12837, 12838, 12839, 12840, 12841, 12842, 12843, 12844, 12845, 12846, 12847, 12848, 12849, 12850, 12851, 12852, 12853, 12854, 12855, 12856, 12857, 12858, 12859, 12860, 12861, 12862, 12863, 12864, 12865, 12866, 12867, 12868, 12869, 12870, 12871, 12872, 12873, 12874, 12875, 12876, 12877, 12878, 12879, 12880, 12881, 12882, 12883, 12884, 12885, 12886, 12887, 12888, 12889, 12890, 12891, 12892, 12893, 12894, 12895, 12896, 12897, 12898, 12899, 12900, 12901, 12902, 12903, 12904, 12905, 12906, 12907, 12908, 12909, 12910, 12911, 12912, 12913, 12914, 12915, 12916, 12917, 12918, 12919, 12920, 12921, 12922, 12923, 12924, 12925, 12926, 12927, 12928, 12929, 12930, 12931, 12932, 12933, 12934, 12935, 12936, 12937, 12938, 12939, 12940, 12941, 12942, 12943, 12944, 12945, 12946, 12947, 12948, 12949, 12950, 12951, 12952, 12953, 12954, 12955, 12956, 12957, 12958, 12959, 12960, 12961, 12962, 12963, 12964, 12965, 12966, 12967, 12968, 12969, 12970, 12971, 12972, 12973, 12974, 12975, 12976, 12977, 12978, 12979, 12980, 12981, 12982, 12983, 12984, 12985, 12986, 12987, 12988, 12989, 12990, 12991, 12992, 12993, 12994, 12995, 12996, 12997, 12998, 12999, 13000, 13001, 13002, 13003, 13004, 13005, 13006, 13007, 13008, 13009, 13010, 13011, 13012, 13013, 13014, 13015, 13016, 13017, 13018, 13019, 13020, 13021, 13022, 13023, 13024, 13025, 13026, 13027, 13028, 13029, 13030, 13031, 13032, 13033, 13034, 13035, 13036, 13037, 13038, 13039, 13040, 13041, 13042, 13043, 13044, 13045, 13046, 13047, 13048, 13049, 13050, 13051, 13052, 13053, 13054, 13055, 13056, 13057, 13058, 13059, 13060, 13061, 13062, 13063, 13064, 13065, 13066, 13067, 13068, 13069, 13070, 13071, 13072, 13073, 13074, 13075, 13076, 13077, 13078, 13079, 13080, 13081, 13082, 13083, 13084, 13085, 13086, 13087, 13088, 13089, 13090, 13091, 13092, 13093, 13094, 13095, 13096, 13097, 13098, 13099, 13100, 13101, 13102, 13103, 13104, 13105, 13106, 13107, 13108, 13109, 13110, 13111, 13112, 13113, 13114, 13115, 13116, 13117, 13118, 13119, 13120, 13121, 13122, 13123, 13124, 13125, 13126, 13127, 13128, 13129, 13130, 13131, 13132, 13133, 13134, 13135, 13136, 13137, 13138, 13139, 13140, 13141, 13142, 13143, 13144, 13145, 13146, 13147, 13148, 13149, 13150, 13151, 13152, 13153, 13154, 13155, 13156, 13157, 13158, 13159, 13160, 13161, 13162, 13163, 13164, 13165, 13166, 13167, 13168, 13169, 13170, 13171, 13172, 13173, 13174, 13175, 13176, 13177, 13178, 13179, 13180, 13181, 13182, 13183, 13184, 13185, 13186, 13187, 13188, 13189, 13190, 13191, 13192, 13193, 13194, 13195, 13196, 13197, 13198, 13199, 13200, 13201, 13202, 13203, 13204, 13205, 13206, 13207, 13208, 13209, 13210, 13211, 13212, 13213, 13214, 13215, 13216, 13217, 13218, 13219, 13220, 13221, 13222, 13223, 13224, 13225, 13226, 13227, 13228, 13229, 13230, 13231, 13232, 13233, 13234, 13235, 13236, 13237, 13238, 13239, 13240, 13241, 13242, 13243, 13244, 13245, 13246, 13247, 13248, 13249, 13250, 13251, 13252, 13253, 13254, 13255, 13256, 13257, 13258, 13259, 13260, 13261, 13262, 13263, 13264, 13265, 13266, 13267, 13268, 13269, 13270, 13271, 13272, 13273, 13274, 13275, 13276, 13277, 13278, 13279, 13280, 13281, 13282, 13283, 13284, 13285, 13286, 13287, 13288, 13289, 13290, 13291, 13292, 13293, 13294, 13295, 13296, 13297, 13298, 13299, 13300, 13301, 13302, 13303, 13304, 13305, 13306, 13307, 13308, 13309, 13310, 13311, 13312, 13313, 13314, 13315, 13316, 13317, 13318, 13319, 13320, 13321, 13322, 13323, 13324, 13325, 13326, 13327, 13328, 13329, 13330, 13331, 13332, 13333, 13334, 13335, 13336, 13337, 13338, 13339, 13340, 13341, 13342, 13343, 13344, 13345, 13346, 13347, 13348, 13349, 13350, 13351, 13352, 13353, 13354, 13355, 13356, 13357, 13358, 13359, 13360, 13361, 13362, 13363, 13364, 13365, 13366, 13367, 13368, 13369, 13370, 13371, 13372, 13373, 13374, 13375, 13376, 13377, 13378, 13379, 13380, 13381, 13382, 13383, 13384, 13385, 13386, 13387, 13388, 13389, 13390, 13391, 13392, 13393, 13394, 13395, 13396, 13397, 13398, 13399, 13400, 13401, 13402, 13403, 13404, 13405, 13406, 13407, 13408, 13409, 13410, 13411, 13412, 13413, 13414, 13415, 13416, 13417, 13418, 13419, 13420, 13421, 13422, 13423, 13424, 13425, 13426, 13427, 13428, 13429, 13430, 13431, 13432, 13433, 13434, 13435, 13436, 13437, 13438, 13439, 13440, 13441, 13442, 13443, 13444, 13445, 13446, 13447, 13448, 13449, 13450, 13451, 13452, 13453, 13454, 13455, 13456, 13457, 13458, 13459, 13460, 13461, 13462, 13463, 13464, 13465, 13466, 13467, 13468, 13469, 13470, 13471, 13472, 13473, 13474, 13475, 13476, 13477, 13478, 13479, 13480, 13481, 13482, 13483, 13484, 13485, 13486, 13487, 13488, 13489, 13490, 13491, 13492, 13493, 13494, 13495, 13496, 13497, 13498, 13499, 13500, 13501, 13502, 13503, 13504, 13505, 13506, 13507, 13508, 13509, 13510, 13511, 13512, 13513, 13514, 13515, 13516, 13517, 13518, 13519, 13520, 13521, 13522, 13523, 13524, 13525, 13526, 13527, 13528, 13529, 13530, 13531, 13532, 13533, 13534, 13535, 13536, 13537, 13538, 13539, 13540, 13541, 13542, 13543, 13544, 13545, 13546, 13547, 13548, 13549, 13550, 13551, 13552, 13553, 13554, 13555, 13556, 13557, 13558, 13559, 13560, 13561, 13562, 13563, 13564, 13565, 13566, 13567, 13568, 13569, 13570, 13571, 13572, 13573, 13574, 13575, 13576, 13577, 13578, 13579, 13580, 13581, 13582, 13583, 13584, 13585, 13586, 13587, 13588, 13589, 13590, 13591, 13592, 13593, 13594, 13595, 13596, 13597, 13598, 13599, 13600, 13601, 13602, 13603, 13604, 13605, 13606, 13607, 13608, 13609, 13610, 13611, 13612, 13613, 13614, 13615, 13616, 13617, 13618, 13619, 13620, 13621, 13622, 13623, 13624, 13625, 13626, 13627, 13628, 13629, 13630, 13631, 13632, 13633, 13634, 13635, 13636, 13637, 13638, 13639, 13640, 13641, 13642, 13643, 13644, 13645, 13646, 13647, 13648, 13649, 13650, 13651, 13652, 13653, 13654, 13655, 13656, 13657, 13658, 13659, 13660, 13661, 13662, 13663, 13664, 13665, 13666, 13667, 13668, 13669, 13670, 13671, 13672, 13673, 13674, 13675, 13676, 13677, 13678, 13679, 13680, 13681, 13682, 13683, 13684, 13685, 13686, 13687, 13688, 13689, 13690, 13691, 13692, 13693, 13694, 13695, 13696, 13697, 13698, 13699, 13700, 13701, 13702, 13703, 13704, 13705, 13706, 13707, 13708, 13709, 13710, 13711, 13712, 13713, 13714, 13715, 13716, 13717, 13718, 13719, 13720, 13721, 13722, 13723, 13724, 13725, 13726, 13727, 13728, 13729, 13730, 13731, 13732, 13733, 13734, 13735, 13736, 13737, 13738, 13739, 13740, 13741, 13742, 13743, 13744, 13745, 13746, 13747, 13748, 13749, 13750, 13751, 13752, 13753, 13754, 13755, 13756, 13757, 13758, 13759, 13760, 13761, 13762, 13763, 13764, 13765, 13766, 13767, 13768, 13769, 13770, 13771, 13772, 13773, 13774, 13775, 13776, 13777, 13778, 13779, 13780, 13781, 13782, 13783, 13784, 13785, 13786, 13787, 13788, 13789, 13790, 13791, 13792, 13793, 13794, 13795, 13796, 13797, 13798, 13799, 13800, 13801, 13802, 13803, 13804, 13805, 13806, 13807, 13808, 13809, 13810, 13811, 13812, 13813, 13814, 13815, 13816, 13817, 13818, 13819, 13820, 13821, 13822, 13823, 13824, 13825, 13826, 13827, 13828, 13829, 13830, 13831, 13832, 13833, 13834, 13835, 13836, 13837, 13838, 13839, 13840, 13841, 13842, 13843, 13844, 13845, 13846, 13847, 13848, 13849, 13850, 13851, 13852, 13853, 13854, 13855, 13856, 13857, 13858, 13859, 13860, 13861, 13862, 13863, 13864, 13865, 13866, 13867, 13868, 13869, 13870, 13871, 13872, 13873, 13874, 13875, 13876, 13877, 13878, 13879, 13880, 13881, 13882, 13883, 13884, 13885, 13886, 13887, 13888, 13889, 13890, 13891, 13892, 13893, 13894, 13895, 13896, 13897, 13898, 13899, 13900, 13901, 13902, 13903, 13904, 13905, 13906, 13907, 13908, 13909, 13910, 1

Vard Specialists in Rotary-Linear Actuation for Industry

BALL SCREW ASSEMBLIES MECHANICAL ACTUATORS HOURGLASS WORK SETS FRACTIONAL H.P. MOTORS

Vard Ball Screwjack assemblies are applicable to all specifications calling for transmission of rotary motion to linear motion. Efficiency varies up to 90%, at power reductions of as much as 66 per cent. Let Vard engineers help solve your problem.

Send For The
VARD
Factbook
Today

Vard

3901 E. COVINGTON STREET
PALM BEACH, FLA. 33480



Miniature HF Alternator Delivers Lots of Power

Lots of power in a small package is provided in this 22-oz high-frequency alternator. It delivers 500 watts at 5,000 c, with the shaft turning at 25,000 rpm. It is one of a line of miniature units with ratings from 125 to 4,000 watts and speeds to 50,000 rpm. Unit shown is Model 37, measuring only 2 1/2 in. in diameter.

D&S, Ltd., 402 E. Colburn St., Santa Barbara, Calif.

ALSO ON THE MARKET

Better protection against fuel-fed fires is provided by automatic shutoff valve which operates like squibbs used in rockets and can be used in aircraft fuel tanks, gasoline supply lines and other equipment. Normally open, it closes instantly when high temperature triggers the actuating ball that releases shutoff spring. Valve also closes to prevent secondary explosions if head is knocked off by blast—Vulco, Inc., 1410 West St., Cincinnati 35.

Laminated plastic ball bearing retainer developed by Synthane reduces weight, friction and galling in sight picture aircraft bearing assemblies, permit smoothly rapid movement to speeds exceeding 150,000 rpm in instrument, engine and supercharger blower applications. Tests show retention is less than with metal. Retainers are oil-lubricating and machined to close tolerances (plus .0005 to .0001 in.) Smallest produced so far: ball type, with 1/64-in. pockets measuring .030 in. id and .141 o.d., for an aircraft instrument—Synthane Corp., Ohio, Pa.

Hansen steel gives protection in case of stove or crash landings. Attached to pilot's shoulder harness and more than meeting military specifications covering MA-2 seats, the Shaggen Hansen Steel has a 14-in. collar, and locks into

another aeroquip first! . . . HOSE LINES THAT CONVEY HOT AIR UP TO 500° F. plus

ANTI-ICING HOSE

and "little gem" fittings

matched for guaranteed performance

"Little Gem" is an Aeroquip Trade Mark



"little gem" FITTING FEATURES

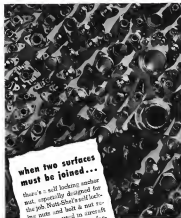
1. HOUSING FOR separate inner tube from retaining wire braid during assembly.
2. CLAMPING ACTION is needed on housing when braid only.
3. LIP SEAL is formed at end of hose over tube ends in anti-leak chamber.

Aeroquip

AEROQUIP CORPORATION, JACKSON, MICHIGAN

305 PRICE STREET - NEW YORK, NEW YORK 10014 - 100 FINE, S. C. - 4001 E. 10th Ave. - DENVER, CO. - 10014 - 10014 - 10014

AEROQUIP PRODUCTS ARE FIRST PROTECTED BY PATENTS IN U.S.A. AND ABROAD



**when two surfaces
must be joined...**

there's a self locking anchor
nut, especially designed for
the job. Nutt-Shel's self lock-
ing nuts and bolts & nut re-
tainers are used to anchor
by every major manufac-
turer.

Nutt-Shel

951 AVENUE, CINCINNATI 2, OHIO
Telephone: (OHIO 4-122) - CINCINNATI 1-5883

SOLE AGENTS FOR THE
MIDLAND DISTRICT: NUTT
SHELLS AND NUT RETAINERS

SYMBOL OF DEPENDABILITY



Parts built to Association from this stamp. It means
correct engineering, testing, fabrication and
quality control. On the final assembly it is your
guarantee of dependable service in use.

For metal fabrication requirements—designing,
tooling and production—can be met on schedule by
Associated. Write

Associated

AN ASSOCIATED TRUST CO.
ASSOCIATED ASSOCIATES, INC.

Company, Inc.

1211 EAST DOUGLAS

WICHITA 3, KANSAS

entirely in an emergency. Capable of
instant release by the pilot, the seat
weighs only 2 lb. complete—Pacific
Scientific Co., 1430 Grande Vista Ave.,
Los Angeles 25.

Spindown locknut is said to be 1/3
lighter in weight than conventional
locknuts. Of high carbon steel, heat-
treated after fabrication, the base of the
emergency nut features, forcing no bolt
into stress area lock thread to lock.—
Thompson-Bremer & Co., 520 N. Dear-
born St., Chicago 22.

Fuel pump designed for the refueling
systems of large jet bombers weighs less
than 4 lb. and can be tested by 1/16 hp.
a.c. or d.c. motor. Vent scavenges fuel
from the aircraft refueling manifold
after breaker is completed. A solenoid
vent-type pump, the unit requires no
lubrication other than the fuel itself
and can be allowed to run dry for short
periods, says the maker—Laird Remick
Div., Elmer, Ohio.

Polaroid paint light detector, specifically
designed for CAA, for use in inspec-
tions, utilizes the light polarization
principle to give continuous and smooth
displaying of polar light intensity from
infrared to blackout. Constructed of



non-ferrous material and finished in a
non-reflective black oxide. Model is a
3/16-27 tapped hole. Accommodates
bumps of the No. 51 and No. 47 size—
TLC Electric Corp., 11 W. 27th St.,
New York 1.

Aircraft torque tube bearing, designed
to save weight and space, is built to
provide full freedom of rotation under
all conditions of misalignment resulting
from mounting inaccuracies and flexing
of airframe members. A double-roller
type, it has positive seal to retain lubri-
cant and prevent oil loss in pressurized
aircraft.—Shen Bearing Corp., Downers
Grove, Ill.

Pressure switch for engine oil or hy-
draulic fluid operates at any differential
between 10 and 250 psi for activation
of control systems, pressure warning or
shutdown devices. Model 44187
measures 2 1/2 in. in diameter. It has a
high over-pressure rating and functions
at 50,000 lb. and low temperatures.—
G. M. Chalmers & Co., Inc., 117 E.
Colorado Street, Box N, Pasadena 1,
Calif.

Aircraft Parts by Eaton

combine outstanding developments in design, metallurgy, and production engineering



Since the early days of World War I, Eaton has
made many important contributions to civilian
and military aircraft engines in design, metal-
lurgy, and production. Eaton's understanding
of the problems peculiar to the aircraft industry has
led to the development of unique, high-volume
production facilities for the manufacture of parts
which meet exacting aircraft standards of quality.

EATON MANUFACTURING COMPANY

CLEVELAND, OHIO

SAGINAW DIVISION: 9771 FRENCH ROAD • DETROIT 13, MICHIGAN

PRODUCTS: Jet Engine Combs, Poppet, and Free Valves • Traps • Hydraulic Valve Lifters • Valve Seal Inserts • Jet
Engine Parts • Motor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Weather-Defender Units • Soap Rings
Spring/Water • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamic Drives • Brakes • Dynamometers

Giant Forging Press Expands Design Concepts

With Alcoa's new 15,000-ton forging press, the larger and more intricate forgings can now be produced. Complete subframe subassemblies forged in a single heat open entire new design concepts... eliminate time-consuming assembly of parts... put stronger muscles on tomorrow's trucks.

Today, Alona farmstead McDonalds Aerotech Corporation with 350-pound, carry-through forgings for their "Demon" jet fighter. Two of these forgings, when machined and finished, replace a series of extrusions and sheet metal build-ups. This results in a saving not only in weight and man-hours, but also in the cost of expensive jigs and fixtures.

Recent years have shown a tremendous increase in the number of applications using aluminum forgings. This is due, partly, to new and better alloys developed by Alcoa, as illustrated in forging

size and complexity; and to the inherent advantages of aluminum, itself... strength, smoothness and corrosion resistance.

Want to know more about these Alcoa facilities? How they can help speed-up your company's production lines? Your local Alcoa sales office has all the information and will be glad to discuss your own particular problems. The number is in the telephone directory—listed under "Aluminum."

Alcoa 
Aluminum

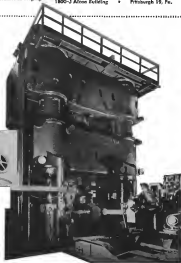
ALUMINUM COMPANY OF AMERICA
1800-J Alcoa Building • Pittsburgh, Pa.

Aircraft and
Parts Manufacturers

Free Alinea "How-To-Do-It" Books—plastic use of award money—are available to help you train your employees. Ask for any of these books: *Forming Alinea Aluminum*, *Hardening Alinea Aluminum*, and *In Alloys*, *Welding and Brazing Alinea Aluminum*, *Etching Alinea Aluminum*, *Dyeing for Alinea Products*, *Alinea Aluminum and In Alloys*. Sound ideas are available on most aluminum processing.



*SEEK NOW™ with Edward E. Muzzey
—CBS-TV every Sunday... bring the
world to your screen. Consult your
newspaper for local time and channel.



FINANCIAL

Income Return on Net Worth

(Colombo 1962)

[illegible]

(2) Estimate the density of 20,000,000 gold ion-polluted ions, assuming a bond, electron at 20,000,000.

(2) *Reproductive Grounds* sold an extensive stock selection of 30–400 100

(E) Includes both the items of 1001 000 and an unpatented tool design. Patented steel, 1 000 units, had a book value of 200 000 000 at the end-1992.

doi:10.1371/journal.pone.0141426

Airline Dividends Far From Big

An erroneous impression of liberal dividend payments by the trunk airlines may have been inadvertently created by Robert B. Murray, Jr., Undersecretary of Commerce for Transportation in a recent New York address. The circumstance assumes special significance in view of the acres of sensitive trading in air transportation now underway by Mr. Murray's office. Profitability of the airlines and their alleged largely to stockholders could figure prominently in these matters.

In fact, cash disbursements to outside stockholders have been relatively limited and far below the rate of returns received by investors in most other industries (Ariavansh Weiss Jan. 25, p. 46).

► **Contradictions**—The Undersecretary, in his New York talk at the Wings Club, stated: "More liberal dividends . . . have been paid by the airlines in recent years. In 1972 . . . they paid over \$12 million in dividends, or 11.9%."

of the book value of the capital stock." Actually, cash dividends by the trust airlines last year aggregated \$12.65 million and represented a mere 3.44% return on the total net worth of the industry.

There are two major deposition influences in the Undersecretary's dividend statement and they both can be readily isolated and defined:

* Included is Murray's dividend completion personally with the 10% stock dividend declared by TWA last year and which was effected on the company's

books by a transfer entry of \$4,511,677. The fact remains that this action was absolutely without significance as far as income was concerned to TWA stockholders. Moreover, while the TWA stockholders received an additional certificate, the value of his holdings in the company's equity remained exactly the same before and after the stock dividend distribution.

• The normal subsequence in the US democracy's dividend statement is the use of the book value of the equity (the capital stock total (\$115.1 billion)) as a base upon which to compute income taxes. The stockholder's undistributed equity consists of capital stock and all surplus accounts. More often than not, most values started the

corporate existence with a minimal stated capital stock account plus paid-in surplus. To this has been added accumulated retained earnings and other accretions achieved throughout the years.

The inventory looks to the entire net worth as an indication of book value (with the capital stock account comprising just one element) and it is on this base upon which income returns on the stockholders' equity can be evaluated.

Accordingly, the domestic bankless aggregate net worth of \$367,096,118 as of the 1952 year-end should be used as a base rather than the \$145.1 million capital stock figure to compute dividend return on book value: The return is then but 3.04%, and not

Available!
HUMPHREY
LINEAR
POTENTIOMETER



NOW FOR THE FIRST TIME—a capped Falschmannite that will give long, silver-blue reflections when cut.

Available predriven. Instantly with clear, sharp signal, because the Humphrey unit is exclusive in internal design. It is fully tested and has been qualified for use in many military applications. Humphrey design service is available to meet your special requirements.

Also available are Humphrey Tate and Tony Gray and American-born Israeli Peacekeepers Custom-built

WHITE OAK HEARST OFFICE, BOSTON WPM



Pacific SCIENTIFIC CO.

1400 Granddale Vista Ave., Los Angeles 15, Cal.
28 Willing Dr., San Francisco 7, California
2712 1st Avenue, South, Seattle 4, Washington



That's the younger generation moving in

Bomber wings at Haze Strategic Air Command bases are now flying Boeing B-47 Stratojets, and other bases will soon have them. These swift new jets are replacing an older generation of Boeing bombers, the renowned B-29 which during the last war helped write relevant chapters of our history.

The newly equipped Air Force units are headquartered at bases in Florida, Arizona and California. Each unit also has a complement of one or more Boeing KC-97 refuelers. Other SAC wings, overseas and in the United States, are

equipped with Boeing B-50 medium bombers.

The Stratojet flies ten miles a minute, and is capable of operating at altitudes well above 40,000 feet. It's classified as a medium bomber, yet carries a bombload of ten tons. Pilots report that it "handles like a fighter."

Revolutionary design gives the Stratojet a performance not previously equaled by aircraft of its dimensions. It was the first bomber to enter the over-600 miles an hour class. The B-47's pioneering design, its powerful in-

crease called for equally advanced maintenance methods. "These methods were devised and perfected by Boeing production and engineering experts."

Today as in B-47 programs, Boeing is turning out over nine pounds of work per man-hour than during its World War II production of the B-29.

Like earlier Boeing, the B-47 Stratojet is magnificently engineered, ruggedly built. It adheres to the uncompromising design and construction standards that for 35 years have made the name Boeing stand for dependability.

BOEING

Boeing is now building a prototype jet transport, designed to be adaptable for either military or commercial use. The new plane has the benefit of Boeing's unparalleled experience in multi-jet aircraft. Built by in 1954

fined Civil Aviation Administration in getting into areas and areas matters that he believes should be left to the industry.

Martin thought this trend during the annual ICAO conference last summer and a contrasting view in the path through the U. S. Airports, Harold Jones (former CAB member).

Cutting international subsidies in some areas will be harder than reducing local service programs because of the argument of foreign companies, Martin's staff believes.

► **GAO Policy-Money** says Commerce Department, under terms of Executive Reorganization Plan 21, now has, a "disputed and only with specific duties in the promotion of aviation but with no overall responsibility for developing a sound and coordinated national transportation policy."

"However," he adds "we are obligated in line with general administrative policy to seek out every possible business opportunity in the government's performance of its transportation activities."

President Eisenhower has given Commerce an express go-ahead to use these powers in full. The President has delegated to Commerce much of his substantial additional power in the field of international aviation rules and subsidy grants.

CAB continues to operate in addition to other matters but must answer to the Administration on major policy and budget items.

► **Rail Ties Cuts-Newest development** of CAA is a radical change in rules regarding air traffic and private flying under director Koch.

The spending network of field units with various specialized responsibilities based in and type will be evolved by closer inspection with more individual case.

Numerical requirements of so many "absolute imperatives" of which each year will give way to the number of checks an inspector believes is necessary.

Another example: If an inspector cannot decide on a case, he will ask the regional director's advice. If an advice does not agree with them, they will ask CAA's Washington office to make the decision.

The old way, still in effect, argues on the field agent more "discretion" though which is slow and expensive and more than branch, division, or state and Washington. First action is Koch's directed duties, then action of routine checks by agents.

A third example: A CAA inspector granting status certificates is special word-of-mouth for advice, much for highway. Safety director Koch says good ones can handle both in many cases.

Main obstacle to quick cleanup of these and other examples of what the present Administration considers as merely bureaucracy.

► **Civil Service regulations:** Certain "grades" have various responsibilities of so many personnel, safety agents often run operations offices. Having these more responsibility and pay often they require reworking of airboard Civil Service laws.

A impact of reductions. Aim is to cut personnel as much as possible through natural job turnover—no hiring of new men. However, threat of reductions will have to be used to speed occupations on occasion.

Airlines and private operators will have to be taught to assume more responsibility, too, the new administration acknowledges. But rapid transition to maximum and type in CAA regulations is a contract.

CAB ORDERS

(Week of Sept. 14-20)

GRANTED:

For American Giant Airways amendment of exemption for special flight to include South Sea, Ltd., for passengers as part of the Pacific Ocean.

Graded Airlines complete test of service to London from Salt, Okla.

Northern Consolidated Airlines permits to stop Alaska service on a route despite ruling that of West Alaska Airlines. This route includes service to Fairbanks, Circle Kongs, Port Taylor and Beaver.

Revised Airlines reduced service of \$16,156 per year. CAA member John Lee

disputed, is he did on a recent Southwest Airlines meeting. Based on the proposed Boeing merger with Northwest—which would be saving the taxpayer at least as much as rate in their accounts.

► **East World Airlines** permits to its post direct route-Minneapolis to serve points, Chicago and Denver, during the check service during Sept. 17-18.

East World Airlines from Atlantic to party mid-air service of \$700,000 a year effective Oct. 1. CAA's maximum subsidy and mid-air rate yielding TWA \$1,500,000 was that much lower than the airlines can potentially make rate (without subsidy) since CAA now will set a firm subsidy rate for TWA.

Northwest Airlines special permission to serve Penn. Route, as well in Seoul and Tokyo, for which it is authorized.

Quick Air Lines note received case in testimony by various new bodies, Central Airlines permit to amend its regulations in the case. CAB also denied Kansas Department of Aviation petition to discontinue from this case the question of whether Eastern Air Lines should be suspended at Overland, K.

Northwest Airlines permission to suspend service to Portland, Me., in the winter season from Oct. 15-Nov. 1.

Philadelphia Chamber of Commerce to transport on M. T. Chicago note rate Northwest Airlines is granted in request to subsidize a route application in this area under.

ORDERED TRANSFERRED:

Scheduled airline mail pay compensation in Post Office, with no subsidy included. This goes direct to Pennsylvania Department of Transportation. This No. 10. Starting Oct. 1, Post Office pays for cost of mail carriage only including "removals," paid almost directly. CAA pays subsidy.

REFUSED:

Emergency regulations restricting nonstop



IATA SEEKS TO IMPROVE RATE PROCEDURES

More efficient and streamlined procedures for international agreements by the airlines on rates subject a long sought by the new traffic advisory committee of the International Air Transport Association, during its third meeting in London. The group is preparing to the next IATA traffic conference to be held in Honolulu at November. Dennis H. Meadows, of Southwestern Airlines System, has been elected chairman of the new committee. Meadows, left in right Philip Lawton, BEA,

G. R. Cooke, TWA, Melvin de Villeneuve, Air France; W. M. Sheehan and E. E. Friess of MATS, Houston; J. W. S. Brinkley, newly appointed IATA traffic director; J. H. Edwards, IATA, W. G. L. Quince, PAA; Dr. F. von Bismarck, KLM and Roy W. Ireland, CAA, who will preside over the Honolulu meetings. Other members of the committee not shown here are Charles N. Brink, Philippine Air Lines and S. E. Koch, Air India International.

to three trips a month between major cities. Regulation was laid up at the courts, and will be most anyone at the end of the long singular circuit investigation.

ATTACHED

Positive administrative agreements among 27 parties of parties.

DETILED

United Air Lines petition for consideration of CAB decision. United-Airline route was one. United had asked and been denied rights to fly direct between Portland, Seattle and eastern ports. United already it would direct 514 million a year from Northwest, but was Northwest was retained rights that would yield \$179,200 still. CAB says the net \$174,000 decrease from Northwest is still too much.

BUSINESS AIRLINES

Business Airlines express for consideration in its route renewal case of a complaint against Southwest Airways, claiming that Southwest practices some unlawful operation of lawfare, CAB.

United Air Lines and Pan American World Airways petition the CAB against certain Southwest Air Line scheduled laws between California and the Hawaiian Islands (Honolulu and Hilo).

DISMISSED

General Aviation from state-to-state route, at request of the company. Flying, CAB said that Alaska is required later for C-45 aircraft chart flights. Cases canceled the traffic.

SUSPENDED

American Airlines reach with last-class rates between New York, Washington and Boston. Rates were suspended June 18, and the order rescues the suspension while CAB completes its investigation. CAB wants that short flights must have such rates, even on short-haul segments.

Air France to Start Chicago-Paris Flights

An France will look to meet United States and Europe with direct service. On 23, flying Concorde from Chicago to Montreal to Paris, Frankfurt, Milan and Rome.



EXCALIBUR FLIES AGAIN

Vought-Sikorsky VS-44A, Excalibur, once the property of the former American Export Airlines, has been refurbished at Baltimore by American Export Airlines and recently was test flown. According to Hugh Wilk, head of AEC, the VS-44A is to be flown

UAL Radar

Results of United Air Lines airborne radar test, to be announced soon, will give some 5.7 km. range, though a decided edge over older 3.3 km. is its ability to see through heavy thunderstorms. UAL test results, which reportedly exceeded radar range of 5.7 km. previously, should enable airlines to proceed with preparation of radar specifications, which had been halted pending decision on the best radar wavelength.

In announcing the new service last week, the French airline did not mention Turbo Compound-powered Super Caravelle will be operated on fast-track flights to Paris and Frankfurt. French Constellation will fly 60-passenger service from Chicago to Paris, with through flights on to Milan and Rome.

CAB Kills Nonsensical Flight Regulation

Civil Aeronautics Board has repealed the economic regulation restricting scheduled airlines to three trips a week between any pair of major cities and eight a week between small cities. The controversial "one-out-of-eight" regulation, placed by the courts on American Air Transport vs. CAB, was killed before it took effect.

The Board gives two major reasons for repeal:
• **Private scheduled airlines** have increased flight frequency voluntarily as a major line. Enforcement of this rule will replace the old regulation.
• **Increased flight frequency** is now the rule, not the exception. The Board concludes that "since that

regulation has never been effective as to any carrier, its repeal is expected to be a benefit, the only effect of which will be to relieve the government and the two carrier parties to the litigation of a substantial burden."

The airlines considered the regulation would have restricted that former freedom and control of airlines to operate without right of adjudicatory hearing.

Bonanza Subsidy Climbs \$220,000

Civil Aeronautics Board increases apparently are covering their losses on subsidy policy.

Regulations on spending more money, while at least one Democrat is trying to stop the trend toward increased payments established under 15 years of Democratic control.

• **\$220,000** Bonanza-Bonanza recently granted a \$220,000 subsidy increase to Bonanza Airlines. Bonanza's John Lee—CAB's most ardent supporter of the local service experiment—led a strong economic thrust, as he recently did in a similar case on Southwest Airways.

Lee says if the two local service carriers had merged, as CAB urged them to do, subsidy increases would not have been necessary.

• **Weighted Rate-Bonanza's** new rate is set to yield the airline \$97,823 a year to subsidy plus \$10,000 compensation for cost of hauling mail. It is effective from last Aug. 30 forward.

The carrier decided it would need \$1,022,742 to break even. The Board weighted this down to \$908,595 plus \$13,218 for profit.

• **"Bonanza Reader"**—Highlights of Lee's dissent to the Bonanza subsidy increase.

"The interest of approximately \$123,000 monthly" contributes an unnecessary burden on the public type, says Lee.

When the Board increased the local service experiment, it was with the full knowledge that the operation would require subsidy. It was hoped, however, that the amount of subsidy required per plane mile of operation could be and would be gradually reduced.

"For a period of time this hope was realized... but during the past 17 months it has been necessary for the Board to increase the total per, either on a temporary or permanent basis, at every local service center in the industry."

"It has been necessary to justify these increases over though they were made necessary through no fault or failure of the management of the carrier. It was with it not the case with recent Bonanza and Southwest. The failure of

these two carriers to merge their operations and thereby substantially reduce their reliance upon the government is not a cause beyond their control."

• **Major Savings**—I believe their failure to do so does not constitute "inefficient and inefficient management" within the meaning of the Civil Aeronautics Act. The modest proceeding which increases Bonanza's mail rate clearly shows the unnecessary burden which the government is required to support.

The example, on the single item of maintenance expense, Bonanza might recognize of an allowance of \$11.25 per hour. This was reduced somewhat and an allowance has been made for maintenance expense equivalent to \$10.50 per hour.

But even that is greatly in excess of the amount the government would be required to pay if the two carriers were merged. Because Southwest's maintenance expense amounts to only \$10.52 per hour.

Los Angeles Protests Air Route Arguments

Los Angeles-Chamber of Commerce of Los Angeles is protesting State Department's seeming preference of San Francisco in a tentative for longer airlines flying, paid Pacific route.

William B. Colborn, Jr., chairman of the chamber's Air Transportation Committee, says agreements have been concluded with both Japan and the Philippines for two Pacific routes, terminating at San Francisco.

"It appears that our State Department is recommending an agreement without due consideration of the No. 1 city on the West Coast," he says. "These agreements apparently were completed with no public announcement and with no effort made to advise interested parties on the West Coast."

The chamber official says Japan Air Lines had reported that "the biggest issue responsible for our rejection of San Francisco as the terminal is the air agreement which does not include Los Angeles as a terminal port."

SHORTLINES

• **Air Research Aviation Service Co.**, Carrier Corp. subsidiary, cut price of Douglas DC-3 from 100,000 to 57,000 due to its sale of this aircraft. Company says it has the only such consideration approved for use with all airport installations.

• **Air Transport Assn.** has changed the

INTERCONTINENTAL



...your best move

IS TO INTERCONTINENTAL... where the winning combination of low cost production and trained men with aircraft know-how will assist you to meet your special needs.

We have become masters at the game because we are subject to "check" by one of the finest inspection departments in the Southwest.

Intercontinental stands ready to meet your exact exacting aircraft requirements... whether it's building complete assemblies, component parts or designing and building industrial machinery for use in your plant.

Write... Today!

Our engineering and production departments CAN solve your problems



INTERCONTINENTAL
MANUFACTURING COMPANY, INC.
GARLAND, TEXAS

Let Doctor "E" Solve YOUR Lubrication Problems Too...

Electrofilm
DRY FILM LUBRICATION

RECOMMENDED

After 15 years of intensive research, Electrofilm has developed a new dry film lubricant that is extremely light and low friction, and is non-toxic, non-flammable, and non-corrosive.

FACTORY IN PENNSYLVANIA

SALE AGENTS

Write for Details to: **ELL** Lubrication Systems and Equipment Co.

ANTI-CORROSION METAL PRODUCTS CO., INC.
Cattletown-Hudson, New York

most of its conversion on helicopters to "A1A Conversion as Retrofit," to include replacements.

► **Bombay International Airport**, Santa Cruz, India, soon will get new ILS landing equipment. A terminal building will be completed next year, and new lighting facilities are being installed. Poona and Ahmedabad are slated to become weather alternate airports for Bombay International, following authorization studies indicating that when Santa Cruz is closed, Poona is open 75% of the time and Ahmedabad 50%.

► **Canadian Pacific Airlines** reports to have delivery of both its Douglas DC-6A cargo planes the month for all cargo service Vancouver-Montreal via Edmonton, The Pas and Toronto (see p. 61). If the Canadian Air Transport Board approves, the CPA's transcontinental cargo operations as served by competitor Trans-Canada, the company plans to sell the DC-6A (bought for \$2.5 million).

► **Capital Airlines** has approved a network. It will show the daily Dore Gurney program on NBC, with national commercials. The 15-week contract specifies that no other airline program shall be taken during the period.

► **International Civil Aviation**, Organization, which began its 64th session for action Dec. 4, two years after signing of the ICAO statute treaty.

► **Lake Central Airlines** reports passenger loadings increased nearly 60% the first eight months this year compared with last year.

► **Northwest Orient Airlines** reports a record 14,377 passengers landed at Seattle Tacoma Airport in August, compared with 11,074 a year ago. Company changed its Anchorage, Alaska, service from Elvertorf AFB to its new \$575,000 installation at Air Force International Airport. NW's converted its Stratocruiser and DC-4 land evacuation equipment from cargo to new applications. Six glass chutes at the main doors. Ropes were carried this.

► **Pan American World Airways** is to send service to Caracas, Venezuela, from time to 18 hours a week, Sept. 5, switched from Conquistador to DC-6Bs.

► **United Air Lines** reports August set an all-time record of 4,350,000 revenue passenger-miles, up 16% from the same month a year ago.

50 years of POWERED FLIGHT

Grand Central Aircraft Co. shares Aviation's half century of historic achievement. It is only the beginning and so on the part, the responsibility of today may be the history of tomorrow. For one half of the period Grand Central has built and grown up with Aviation, through hard times as well as good. It is anxious to continue to look forward to our share of the future with constant quality workmanship and "pulling together" spirit, this means delivery to our country's defense through on schedule.



Opportunities in ELECTRONICS

Grand Central is seeking high caliber, experienced and qualified men of integrity, to participate in the long range B-17 aircraft modification program, at our Tucson, Arizona Division.

Full employee benefits and high salary scales, with living and recreational facilities are among the best anywhere in the country. Grand Central employees have found that their work over the past quarter century period has given them tremendous prestige—where you join the "Grand Central Family" you share in this prestige. You'll like the work with the "pulling together" spirit together with an excellent opportunity, based on merit and initiative.

MAIL THIS COUPON TODAY

Personal Manager, Grand Central Aircraft Co.
Postoffice Box 3072, Tucson, Arizona

Name _____

Address _____

City and state _____

I am qualified in the category checked below and wish further information

☐ Aeronautical Engineer ☐ Electrical Engineer
☐ Electronic Technician ☐ 5

GRAND CENTRAL AIRCRAFT CO.

GLENDAL, CALIFORNIA • • • TUCSON, ARIZONA
Grand Central Airport Municipal Airport

COCKPIT VIEWPOINT

By Capt. R. C. Nelson

Readable Reasoning

The engineering and safety literature, consisting of conference meetings, accident reports, notices, notices, notices and other papers which contain all sorts of data from various groups at times give the industry reader an air of a literary society than of an engineering society actually devoted to the advancement of airplanes.

These documents are read, of course, for the information they contain or sometimes simply because they are required reading. However, when seen using this paper, they can usually help making comparisons between styles and judging the literary value of each. Those which would appear to be of value are read and appreciated. Others which appear dull and are being more quickly discarded.

Not Shakespeare—Also important, albeit unfortunate, is the fact that the reader may be misled by writing into author's style. There obviously is no way in which that can be done with a technical engineering report and industry reports are no exception. It is this philosophy doesn't make it any easier to get beyond the first paragraph.

So it is a general pleasure when a document appears which is both technically accurate and highly readable. You feel you have found something worthwhile.

Of such reports is the report of the fifth technical conference of International Air Transport Assn. held at Copenhagen in May 1952 (although not actually distributed). It relates to the problems affecting fuel approach and landing.

Admittedly this is a subject area and due to this article. It long has been felt here that the paper of aviation is too much applied, and since pilots might be called the "prime mover" the solutions to some problems would come from them. They were attacked from the operational view. IATA seems well acquainted with this practical thought.

A Pilot's View—The cause of the meeting, as portrayed through the minutes, indicates these people were as serious. They know the problems of flying an airplane and about them as well as a pilot. Regarding that landing a modern transport is a technical business under certain conditions they agree that if the pilot's job is made easier, then accidents will be fewer. What a wonderful outlook!

There also is the distinct impression in these papers that here was a meeting devoted to the most practical problem of the transport conference: the landing phase of the flight, the approach, the inspection view and comparison of conditions. These people actually said what had to be said because it was the truth. There's that!

General objective of this meeting was to "increase safety and the degree of approach means an increased number of accidents." They also wanted to "assure that the development and utilization of systems for shortening approach and landing are based on sound principles and operating procedures."

Frankly it is a novel experience to see the emphasis put on safety in actual operating procedures—especially liberating aircraft—made controlled conditions—no demand good enough for everyday usage.

Good Ideas—This report is the type that should be seen more often, for it has appeal. Few organizations come close to the caliber of the thinking expressed here, regardless of field of endeavor, and the readable language used is something the industry is good.

So a subsequent article will follow significant part of the work to illustrate the practical outlook of the IATA group. It would not be unfair, however, for everyone connected with aviation to read (it could well be better) this report.

AVIATION CALENDAR

Sept. 24-30—Month annual meeting, National Electronics Conference, Hotel Sherman, Chicago.

Sept. 24-Oct. 1—American Institute of Aeronautical Engineers, public relations department, Grand Sheraton Hotel, Charleston, W. Va.

Sept. 24-Oct. 1—SAE National Aeronautics Meeting, Aircraft Engineering Division and Aircraft Production Section, Hotel Sheraton, Los Angeles.

Sept. 30-Oct. 2—Annual technical symposium conference, American Institute of Electrical Engineers, Aerospace Division, Hotel Sheraton, Los Angeles.

Sept. 30-Oct. 2—Series of seminars on transonic testing in wind tunnels, Frosch Conference, Lafayette, Ind.

Oct. 14-16—Air Reserve Assn.'s annual convention, Anytown Hotel, Colorado, Colo.

Oct. 5-9—International Air Transport Assn., general meeting, Montreal.

Oct. 9-21—National Safety Congress and Exposition, Chicago. Aeronautical section session will be held at the Hotel Sheraton, as arranged at the Grand Hotel.

Oct. 10—England-Chandlers (New Zealand) air race.

Oct. 13-15—Air Transport Assn.'s annual Engineering and Maintenance Conference, Sheraton Hotel, Miami Beach, Fla.

Oct. 14-15—Aircraft Electrical Development and Exposition conference, sponsored by New York Dept. of Commerce, Grand Central Hotel, New York, N. Y.

Oct. 15-16—Aircraft Electrical Society, 10th annual display meeting, Los Angeles Convention Center, Los Angeles.

Oct. 15-25—National Month Congress, City Auditorium, Cleveland.

Oct. 22-23—Radio Technical Conference for Aeronautics, 1951 fall assembly, Sheraton Park Hotel, Washington, D. C.

Oct. 23—National Advisory Committee for Aeronautics, annual meeting, Flight University Institute of Technology, Champaign, Ill.

Oct. 23-24—Fourth annual National Aeronautics Symposium, American Research Foundation of Aeronautical Institute of Technology, exchange facilities and airport will be discussed by NACA in D. C.

Oct. 25-26—Southwestern Airport Managers Assn., annual conference, Miraluna Hotel, Los Angeles, Calif.

Nov. 3-4-1951 Transport Assn. Indian Council Conference, "for Vickers, Inc., Grand Park Sheraton, Detroit.

Nov. 4-6—Society of Automotive Engineers, meeting of committee on aircraft in flight and pneumatic equipment, Sheraton Hotel, Washington, D. C.

Nov. 17-18—Oreochlor Research Society of America, first regular meeting, National Bureau of Standards, Washington, D. C.

Nov. 17-18—Aviation Division and Manufacturers Assn., 13th annual meeting, Sheraton Hotel, Los Angeles.

Nov. 19-20—National Aeronautics Trade Assn., 14th annual convention, Hotel Broadview, Wichita.

Dec. 13—Development Wright Brothers Lecture, U. S. Chamber of Commerce building, Washington, D. C.

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—SEPTEMBER 26, 1953

40	AVIATION WEEK—SEPTEMBER 26, 1953	41	WORTH ENGINEERING LIMITED AND
41	WORTH ENGINEERING LIMITED AND	42	WORTH ENGINEERING LIMITED AND
42	WORTH ENGINEERING LIMITED AND	43	WORTH ENGINEERING LIMITED AND
43	WORTH ENGINEERING LIMITED AND	44	WORTH ENGINEERING LIMITED AND
44	WORTH ENGINEERING LIMITED AND	45	WORTH ENGINEERING LIMITED AND
45	WORTH ENGINEERING LIMITED AND	46	WORTH ENGINEERING LIMITED AND
46	WORTH ENGINEERING LIMITED AND	47	WORTH ENGINEERING LIMITED AND
47	WORTH ENGINEERING LIMITED AND	48	WORTH ENGINEERING LIMITED AND
48	WORTH ENGINEERING LIMITED AND	49	WORTH ENGINEERING LIMITED AND
49	WORTH ENGINEERING LIMITED AND	50	WORTH ENGINEERING LIMITED AND
50	WORTH ENGINEERING LIMITED AND	51	WORTH ENGINEERING LIMITED AND
51	WORTH ENGINEERING LIMITED AND	52	WORTH ENGINEERING LIMITED AND
52	WORTH ENGINEERING LIMITED AND	53	WORTH ENGINEERING LIMITED AND
53	WORTH ENGINEERING LIMITED AND	54	WORTH ENGINEERING LIMITED AND
54	WORTH ENGINEERING LIMITED AND	55	WORTH ENGINEERING LIMITED AND
55	WORTH ENGINEERING LIMITED AND	56	WORTH ENGINEERING LIMITED AND
56	WORTH ENGINEERING LIMITED AND	57	WORTH ENGINEERING LIMITED AND
57	WORTH ENGINEERING LIMITED AND	58	WORTH ENGINEERING LIMITED AND
58	WORTH ENGINEERING LIMITED AND	59	WORTH ENGINEERING LIMITED AND
59	WORTH ENGINEERING LIMITED AND	60	WORTH ENGINEERING LIMITED AND
60	WORTH ENGINEERING LIMITED AND	61	WORTH ENGINEERING LIMITED AND
61	WORTH ENGINEERING LIMITED AND	62	WORTH ENGINEERING LIMITED AND
62	WORTH ENGINEERING LIMITED AND	63	WORTH ENGINEERING LIMITED AND
63	WORTH ENGINEERING LIMITED AND	64	WORTH ENGINEERING LIMITED AND
64	WORTH ENGINEERING LIMITED AND	65	WORTH ENGINEERING LIMITED AND
65	WORTH ENGINEERING LIMITED AND	66	WORTH ENGINEERING LIMITED AND
66	WORTH ENGINEERING LIMITED AND	67	WORTH ENGINEERING LIMITED AND
67	WORTH ENGINEERING LIMITED AND	68	WORTH ENGINEERING LIMITED AND
68	WORTH ENGINEERING LIMITED AND	69	WORTH ENGINEERING LIMITED AND
69	WORTH ENGINEERING LIMITED AND	70	WORTH ENGINEERING LIMITED AND
70	WORTH ENGINEERING LIMITED AND	71	WORTH ENGINEERING LIMITED AND
71	WORTH ENGINEERING LIMITED AND	72	WORTH ENGINEERING LIMITED AND
72	WORTH ENGINEERING LIMITED AND	73	WORTH ENGINEERING LIMITED AND
73	WORTH ENGINEERING LIMITED AND	74	WORTH ENGINEERING LIMITED AND
74	WORTH ENGINEERING LIMITED AND	75	WORTH ENGINEERING LIMITED AND
75	WORTH ENGINEERING LIMITED AND	76	WORTH ENGINEERING LIMITED AND
76	WORTH ENGINEERING LIMITED AND	77	WORTH ENGINEERING LIMITED AND
77	WORTH ENGINEERING LIMITED AND	78	WORTH ENGINEERING LIMITED AND
78	WORTH ENGINEERING LIMITED AND	79	WORTH ENGINEERING LIMITED AND
79	WORTH ENGINEERING LIMITED AND	80	WORTH ENGINEERING LIMITED AND
80	WORTH ENGINEERING LIMITED AND	81	WORTH ENGINEERING LIMITED AND
81	WORTH ENGINEERING LIMITED AND	82	WORTH ENGINEERING LIMITED AND
82	WORTH ENGINEERING LIMITED AND	83	WORTH ENGINEERING LIMITED AND
83	WORTH ENGINEERING LIMITED AND	84	WORTH ENGINEERING LIMITED AND
84	WORTH ENGINEERING LIMITED AND	85	WORTH ENGINEERING LIMITED AND
85	WORTH ENGINEERING LIMITED AND	86	WORTH ENGINEERING LIMITED AND
86	WORTH ENGINEERING LIMITED AND	87	WORTH ENGINEERING LIMITED AND
87	WORTH ENGINEERING LIMITED AND	88	WORTH ENGINEERING LIMITED AND
88	WORTH ENGINEERING LIMITED AND	89	WORTH ENGINEERING LIMITED AND
89	WORTH ENGINEERING LIMITED AND	90	WORTH ENGINEERING LIMITED AND
90	WORTH ENGINEERING LIMITED AND	91	WORTH ENGINEERING LIMITED AND
91	WORTH ENGINEERING LIMITED AND	92	WORTH ENGINEERING LIMITED AND
92	WORTH ENGINEERING LIMITED AND	93	WORTH ENGINEERING LIMITED AND
93	WORTH ENGINEERING LIMITED AND	94	WORTH ENGINEERING LIMITED AND
94	WORTH ENGINEERING LIMITED AND	95	WORTH ENGINEERING LIMITED AND
95	WORTH ENGINEERING LIMITED AND	96	WORTH ENGINEERING LIMITED AND
96	WORTH ENGINEERING LIMITED AND	97	WORTH ENGINEERING LIMITED AND
97	WORTH ENGINEERING LIMITED AND	98	WORTH ENGINEERING LIMITED AND
98	WORTH ENGINEERING LIMITED AND	99	WORTH ENGINEERING LIMITED AND
99	WORTH ENGINEERING LIMITED AND	100	WORTH ENGINEERING LIMITED AND



AMERICA'S AIRCRAFT GUARD THE PEACE WITH PASTUSHIN TANKS

Added range for our combat planes means striking deeper behind enemy lines — hitting where it hurts. Pastushin pistonable fuel tanks, lighter, stronger — the product of long and specialized experience — give our military planes added efficiency in combat or in patrolling America's Air Frontier.

RESEARCH • DESIGN • DEVELOPMENT • PRODUCTION

Special emphasis is on research, design and development for pistonable fuel tanks, the product of long and specialized experience.



PASTUSHIN AVIATION CORPORATION

3000 AIRPORT, AIRPORT, 100 AIRPORT, AIRPORT

self-locking fasteners

Elastic Stop nuts



HEX NUT



SPLINE NUT



HIGH TENSILE NUT



CLINCH NUT



1200° F. HIGH-TEMP. NUT



GANG
CHANNEL NUTS



FLOATING ANCHOR NUT

Every major aircraft now being assembled relies on the vibration-proof holding power of ELASTIC STOP nuts. Only ESNA manufactures a complete line of all types and sizes of self-locking nuts.



**ELASTIC STOP NUT CORPORATION
OF AMERICA**

Rollpins



dia. from 1/16" to 1/2"

Rollpins are slotted, tubular steel, pressed-fit pins with chamfered ends. They drive easily into holes drilled to normal tolerances, compressing as driven. Extra assembly steps like hole reaming or peening are eliminated. Rollpins *lock* in place, yet are readily removed with a punch and may be reused.

Cut assembly costs by using Rollpins as set screws, positioning dowels, clevis or hinge pins. Specify them in place of straight, serrated, tapered or cotter type pins.



*Mail Coupon
for Design
information*

Elastic Stop Nut Corporation of America
Dept. N34-925, 2330 Vauxhall Road, Union, N. J.

Please send me the following free fastening information:

- ☐ Elastic Stop Nut Bulletin
☐ Rollpin Bulletin
☐ AN-ESNA Conversion Chart

- ☐ Here is a drawing of our product. What fastener would you suggest?

Name _____ Title _____

Firm _____

Street _____

City _____ Zone _____ State _____